8° Am. B. 3040
(478)

Proceedings

54TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 131.

REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING

THE FISCAL YEAR ENDED JUNE 30, 1896.

DECEMBER 18, 1896.—Referred to the Committee on Military Affairs and ordered to be printed.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1897.

BIBLIOTHECA
REGIA
MONACENSIS

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made by the United States testing machine during the year ending June 30, 1896.

WAR DEPARTMENT,
Washington, D. C., December 14, 1896.

SIR: I have the honor to transmit herewith, as required by law, the report of the commanding officer of the Watertown Arsenal of "Tests of iron, steel, and other materials for industrial purposes," made by the United States testing machine during the fiscal year ended June 30, 1896.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,
Watertown, Mass., December 3, 1896.

SIR: I have the honor to submit herewith the following report of tests of metals, etc., made at this arsenal during the fiscal year ending June 30, 1896, in compliance with the requirements of law:

The total number of specimens tested during the year was 2,070, classified as follows:

Gun specimens	105
For Ordnance Department	293
For other Government Departments	352
Investigative tests	236
Tests for private parties	1,084
Total	2,070

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$10,000.00
Received from private parties during the year	1,148.33
Total received	11,148.33
Amount expended for service and labor	9,890.25
Amount expended for light, power, and tools, implements and materials for test	1,258.08
Total expended	11,148.33

As in preceding years, the work of the testing machine has consisted of the test and examination of material representing the current work of the Ordnance Department and material from other departments of the Government, work of an investigative nature on the physical properties of constructive material, and the tests of material for private parties who have had tests made on the testing machine as provided for by law.

The tests made for the Ordnance Department include specimens representing metal used in the construction of seacoast guns, in the manufacture of small arms, and the construction of disappearing gun carriages.

For the latter work there were also proof stresses applied to piston and suspension rods.

Small-arms rifle barrels were examined after modified methods of treatment in heating for rolling the barrels.

There were specimens for mechanical tests, and a large number of samples for chemical analysis from the material used in the construction of the Rock Island Bridge.

Tests of cast iron and bronze from the arsenal foundry have been made, showing the quality of metal used in projectiles and carriage work in process of construction at this arsenal, and the material furnished other arsenals.

Helical springs for 7-inch and 12-inch mortar carriages were tested.

Copper cylinders for use in crusher gauges were initially compressed, and tables for their use prepared.

For other departments of the Government, chain cable and chain iron was tested for the Bureau of Equipment, Navy Department; a gas tube for the Signal Service, War Department, and shot lines for the Life-Saving Service, Treasury Department.

The resistance of banded shell in the bore of rifle guns was made the subject of experimental inquiry. Tests were made with 3.2-inch steel B. L. rifled field pieces, a 5-inch B. L. steel siege rifle, a 7-inch B. L. steel siege howitzer, and 8-inch and 10-inch steel B. L. rifles.

The experiments showed the resistance of the bands when forcing the shells through the bores of the guns.

Observations were made at frequent intervals, hence the details of the tests and the diagrams show the curves of resistance at different parts of the bore.

A crest of high resistance was met in the first inch of travel, or while the band was taking the form of the rifling, and again a high resistance was met when the band on the projectile reached the end of the forcing cone, in guns having this feature.

From this point there was a gradual decline in resistance while the projectile traveled along the bore, although the resistance still remained of considerable magnitude throughout the tests.

Modifications were made in the shape of bands, and their resistances were then determined. A reduction in the amount of metal in the band displaced by the lands results in a reduction in resistance.

The expediency of a reduction in cross-sectional area of the band proportioned to the weight of the projectiles to obtain less resistance in the guns would necessarily require for solution some observations made in firing. These results are important and instructive for comparative purposes.

The interval of time in which deformation of the band takes place in the gun presents a phase of the question not covered by the present experiments.

In the test of the 7-inch howitzer there were observations made on the influence of the rate of travel of the shell, and in that experiment it was found that a resistance of 70,000 pounds could be maintained under a comparatively rapid speed for the testing machine, or that at a slower rate of travel the resistance could at will be maintained at 60,000 pounds.

There were other instances in which varying the speed within the limits permitted by the testing machine did not result in material difference in the resistance of the band.

The condition of the rifling, the smoothness of the lands and grooves, exerts a marked influence on the resistance of the band at the experimental rate of speed.

The high resistance of the 3.2-inch gun fouled by means of three blank cartridges further shows the influence of the condition of the bore on the band resistance.

There were riveted-joint tests representing the types of joints used in steam boilers where great strength is required. These tests are accompanied by complete micrometer observations showing their behavior under different loads. Other tests were made on riveted and bolted joints.

In the class of building material additional tests were made on the elastic properties of bricks.

Their moduli of elasticity and the ratios of lateral to direct strains were determined, their coefficients of expansion, absorption of water, and the expansion due to freezing while saturated with water.

Culvert pipes were tested by compression loads between wooden cushions placed on opposite sides of the exterior cylindrical surface of each.

There were compression tests of posts of Douglas fir and white oak wood.

Tests of the former also include tensile tests and moduli of elasticity determinations under tension loads applied parallel to the grain, also compression loads applied parallel to the grain, and crosswise to the grain both radially and tangentially with reference to the position of the stick in the tree.

Tests on cordage were resumed, the purpose being to carry out a series of tests which shall comprise the commercial sizes of cordage of different fibers, and establish, according to present practice in rope making, the relation which exists between rope of different sizes.

In addition to the plain tensile tests the elongations were measured, and resilience determined as loads were released.

A number of short pieces were cut off several sizes of rope, the ends squared, and then the samples were unlaid.

The lengths of the strands were measured, and after which the individual yarns composing a strand.

In this manner the variations in length of the component parts of the ropes were ascertained.

Further tests in this series will be included in the report of 1897.

During the fiscal year passed, much has been done in improving the condition of the testing building and in the arrangement of accessory tools.

The interior of the main testing laboratory has been renovated, the steam engine, pump, rotating apparatus, and machine tools for the preparation of specimens have been located in a separate room, removing all running machinery from the main laboratory.

The modifications in hydraulic piping, made necessary by these changes, have been completed.

A room has been provided for the preservation of interesting specimens. The chemical laboratory has been located and refitted in the second story of an adjacent building, the lower story being used for storage purposes.

To Mr. J. E. Howard, C. E., who has had charge of the testing machine since it was first set up, acknowledgment is due for accurate and faithful work, and for the scope of the investigative tests. His labors are invaluable to the Government.

Very respectfully, your obedient servant,

J. W. REILLY,
Major, Ordnance Department U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. A.,
Washington, D. C.

REPORT

OF THE

TESTS OF METALS AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING THE

FISCAL YEAR ENDED JUNE 30, 1896.

TABLE OF CONTENTS.

		Page.
1.	10-inch steel B. L. rifles, tubes, and jackets	11
2.	12-inch steel B. L. rifles, tubes, and jackets	39
3.	Rifle-barrel steel, .30 caliber	51
4.	Rifle-barrel steel, subjected to special treatment	77
5.	Rifle barrels, hardness and tensile strength	114
6.	Receivers of rifles, .30 caliber	117
7.	10-inch disappearing gun-carriage metal	121
8.	Piston rods and suspension rods, proof stress	133
9.	Steel for Rock Island Bridge	135
10.	Resistance of banded shells when forced through bores of rifled guns	141
11.	Helical springs	191
12.	Steel springs	201
13.	Steel plate	202
14.	Cast iron and pig irons	203
15.	Chain cable and chain iron	229
16.	Bronze	235
17.	Copper cylinders for pressure gauges	239
18.	Riveted joints	245
19.	Riveted and bolted joints	277
20.	Gas tube	341
21.	Wrought iron	344
22.	Bricks, elasticity and absorption of water	345
23.	Building block	372
24.	Culvert pipe	373
25.	Douglas fir wood	379
26.	White oak wood	417
27.	Chemical analyses	429
28.	Steel-wire rope	435
29.	Cordage, manila and hemp	457
30.	Shot lines	477
31.	Private tests	487

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE NO. 17.

No. 5379.

Marks, $^{10}_{B}\,R_{17}\,^{T}_{T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000267	.000134	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	.000033	.000033	
10,250	41,000	.001367	.000067	.....	.....	
10,500	42,000	.001467	.000100	.....	.....	
10,750	43,000	.001533	.000066	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001667	.000067	.....	.....	Elastic limit.
11,500	46,000	.001867	.000200	.....	.....	
11,750	47,000	.002100	.000233	.....	.....	
12,000	48,000	.002733	.000633	.....	.....	
12,250	49,000	.003267	.000534	.....	.....	
12,500	50,000	.004600	.001333	.....	.....	
19,890	79,560	.0433	.0387	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,560
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.0433
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.014
Reduction in area after rupture, per cent of original section		4.8
Position of rupture		″.2 from neck
Character of broken surface		granular, radiating from a dull spot at the circumference
Elongation of inch sections		″.06*, ″.03, ″.04

Tube No. 17.

No. 5380.

Marks, $\frac{10\ R_{17}\ T}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000233	.000166	.....	.....	
5,000	20,000	.000567	.000334	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001033	.000133	0.		
10,000	40,000	.001267	.000234	0.		
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001567	.000134	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	Elastic limit.
12,250	49,000	.001967	.000300	.....	.....	
12,500	50,000	.004000	.002033	.....	.....	
12,750	51,000	.005700	.001700	.....	.....	
13,000	52,000	.006500	.000800	.....	.....	
13,250	53,000	.007633	.001133	.....	.....	
21,190	84,760	.1433	.135667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	84,760
Elastic limit, per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.2167
Elongation per inch under strain at elastic limit	do	.001667
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.14 from neck
Character of broken surface		silky
Elongation of inch sections		″.32*, ″.22, ″.11

TUBE NO. 18.

No. 5381.

Marks, $\overset{10\ R_{18}\ T}{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001433	.000066	.....	.....	Elastic limit.
11,250	45,000	.001567	.000134	.....	.....	
11,500	46,000	.001667	.000100	.....	.....	
11,750	47,000	.001767	.000100	.....	.....	
12,000	48,000	.002167	.000400	.....	.....	
12,250	49,000	.002733	.000566	.....	.....	
21,680	86,720	.1300	.127267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,720
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.2 from neck
Character of broken surface		silky
Elongation of inch sections		″.10, ″.22, ″.32*

TUBE NO. 18.

No. 5382.

Marks, $\overset{10}{M}\ \overset{R_{18}}{T_1}\ \overset{T}{O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001667	.000067	.....	.....	Elastic limit.
12,500	50,000	.003667	.002000	.....	.....	
12,750	51,000	.005333	.001666	.....	.....	
13,000	52,000	.006433	.001100	.....	.....	
13,250	53,000	.007500	.001067	.....	.....	
13,500	54,000	.009000	.001500	.....	.....	
21,430	85,720	.1533	.1443	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,720
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.14 from neck
Character of broken surface		silky
Elongation of inch sections		″.37*, ″.20, ″.13

TUBE.

No. 5391.

Marks, $\overset{6306\ B_1}{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	0.	.....	
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	Elastic limit.
12,000	48,000	.002000	.000467	.....	.....	
12,250	49,000	.002700	.000700	.....	.....	
12,500	50,000	.003533	.000833	.....	.....	
12,750	51,000	.004500	.000967	.....	.....	
13.000	52,000	.005667	.001167	.....	.....	
22,410	89,640	.130000	.124333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,640
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.35 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.32*, ″.23

TUBE.

No. 5390

Marks, $\overset{6306\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001433	0.	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001633	.000066	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.001967	.000300	.....	.....	
13,250	53,000	.002833	.000866	.....	.....	
13,500	54,000	.004333	.001500	.....	.....	
13,750	55,000	.005500	.001167	.....	.....	
14,000	56,000	.006667	.001167	.....	.....	
22,720	90,880	.1233	.116633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,880
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.27 from neck
Character of broken surface		silky
Elongation of inch sections		″.12, ″.26*, ″.17

TUBE.

No. 5469.

Marks, $\frac{6326\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	Elastic limit.
12,250	49,000	.006333	.004633	.....	.....	
12,500	50,000	.007400	.001067	.....	.....	
12,750	51,000	.008267	.000867	.....	.....	
13,000	52,000	.009167	.000900	.....	.....	
13,250	53,000	.010000	.000833	.....	.....	
21,860	87,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	87,440
Elastic limit per square inch of original section	do	48,000
Elongation per inch after rupture	inch	.2400
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.14, ″.43*, ″.15

TUBE.

No. 5468.

Marks, $\overset{6326\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2.500	10,000	.000333	.000233	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001033	.000366	----------	----------	
8,750	35,000	.001200	.000167	0.	----------	
10,000	40,000	.001367	.000167	0.	----------	
10,250	41,000	.001400	.000033	----------	----------	
10,500	42,000	.001433	.000033	----------	----------	
10,750	43,000	.001500	.000067	----------	----------	
11,000	44,000	.001533	.000033	----------	----------	
11,250	45,000	.001567	.000034	----------	----------	
11,500	46,000	.001600	.000033	----------	----------	
11,750	47,000	.001633	.000033	----------	----------	
12,000	48,000	.001667	.000034	----------	----------	
12,250	49,000	.001700	.000033	----------	----------	
12,500	50,000	.001767	.000067	----------	----------	Elastic limit.
12,750	51,000	.001867	.000100	----------	----------	
13,000	52,000	.005433	.003566	----------	----------	
13,250	53,000	.006167	.000734	----------	----------	
13,500	54,000	.007500	.001333	----------	----------	
13,750	55,000	.008500	.001000	----------	----------	
22,320	89,280	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,280
Elastic limit per square inch of original section	do	50,000
Elongation per inch after rupture	inch	.2433
Elongation per inch under strain at elastic limit	do	.001767
Reduction in diameter at point of rupture	do	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.16, ″.42*, ″.15

TUBE.

No. 5475.

Marks, $\frac{6816\ B_1}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001033	.000366	----------	----------	
8,750	35,000	.001200	.000167	0.	----------	
10,000	40,000	.001367	.000167	0.	----------	
10,250	41,000	.001400	.000033	----------	----------	
10,500	42,000	.001433	.000033	----------	----------	
10,750	43,000	.001500	.000067	----------	----------	
11,000	44,000	.001567	.000067	----------	----------	
11,250	45,000	.001600	.000033	----------	----------	Elastic limit.
11,500	46,000	.002000	.000400	----------	----------	
		.005067	.003067	----------	----------	
11,750	47,000	.005567	.000500	----------	----------	
12,000	48,000	.006500	.000933	----------	----------	
12,250	49,000	.007333	.000833	----------	----------	
12,500	50,000	.008333	.001000	----------	----------	
21,070	84,280	.1400	.131667	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	84,280
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2367
Elongation per inch under strain at elastic limit	do	.001600
Reduction in diameter at point of rupture	do	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.42*, ″.16

TUBE.

No. 5474.

Marks, $\frac{6816\ B_1}{M\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001833	.000066	.....	.....	Elastic limit.
13,500	54,000	.003267	.001434	.....	.....	
13,750	55,000	.006500	.003233	.....	.....	
14,000	56,000	.007333	.000833	.....	.....	
14,250	57,000	.008200	.000867	.....	.....	
14,500	58,000	.009167	.000967	.....	.....	
23,000	92,000	.1333	.124133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,000
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		″.70 from neck
Character of broken surface		silky, 60 per cent; granular, 40 per cent
Elongation of inch sections		″.32*, ″.15, ″.12

TUBE.

No. 5479.

Marks, $\frac{6361\ B_1}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000700	.000367	----------	----------	
7,500	30,000	.001033	.000333	----------	----------	
8,750	35,000	.001200	.000167	.000033	.000033	
10,000	40,000	.001367	.000167	.000033	0.	
10,250	41,000	.001433	.000066	----------	----------	
10,500	42,000	.001467	.000034	----------	----------	
10,750	43,000	.001500	.000033	----------	----------	
11,000	44,000	.001567	.000067	----------	----------	
11,250	45,000	.001633	.000066	----------	----------	Elastic limit.
11,500	46,000	.001867	.000234	----------	----------	
		.004667	.002800	----------	----------	
11,750	47,000	.005900	.001233	----------	----------	
12,000	48,000	.006500	.000600	----------	----------	
12,250	49,000	.007333	.000833	----------	----------	
12,500	50,000	.008333	.001000	----------	----------	
21,290	85,160	.1433	.134967	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	85,160
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.2333
Elongation per inch under strain at elastic limit	do	.001633
Reduction in diameter at point of rupture	do	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.65 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.42*, ″.12

TUBE.

No. 5478.

Marks, $\overset{6361\ B_1}{M\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	0.	.....	
10,250	41,000	.001433	.000066	.....	.....	
10,500	42,000	.001467	.000034	.....	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001667	.000067	.....	.....	
11,750	47,000	.001700	.000033	.....	.....	
12,000	48,000	.001733	.000033	.....	.....	
12,250	49,000	.001800	.000067	.....	.....	
12,500	50,000	.001833	.000033	.....	.....	Elastic limit.
12,750	51,000	.002167	.000334	.....	.....	
13,000	52,000	.005667	.003500	.....	.....	
13,250	53,000	.007667	.002000	.....	.....	
13,500	54,000	.008667	.001000	.....	.....	
13,750	55,000	.009333	.000666	.....	.....	
22,610	90,440	.1400	.130667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,440
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.29 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.29*, ″.12

TUBE.

No. 5530.

Marks, $\frac{6030\ B_1}{M\ T_{10}\ M.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000700	.000367	----------	----------	
7,500	30,000	.001067	.000367	----------	----------	
8,750	35,000	.001200	.000133	0.	----------	
10,000	40,000	.001400	.000200	.000033	.000033	
10,250	41,000	.001433	.000033	----------	----------	
10,500	42,000	.001467	.000034	----------	----------	
10,750	43,000	.001500	.000033	----------	----------	
11,000	44,000	.001567	.000067	----------	----------	Elastic limit.
11,250	45,000	.003167	.001600	----------	----------	
11,500	46,000	.004133	.000966	----------	----------	
11,750	47,000	.005000	.000867	----------	----------	
12,000	48,000	.006167	.001167	----------	----------	
12,250	49,000	.007333	.001166	----------	----------	
22,410	89,640	.1500	.142667	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	89,640
Elastic limit per square inch of original section	do	44,000
Elongation per inch after rupture	inch	.2133
Elongation per inch under strain at elastic limit	do	.001567
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.36*, ″.18, ″.10

TUBE.

No. 5534.

Marks, $\frac{7407\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001467	.000067	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	Elastic limit.
11,750	47,000	.004500	.002867	.....	.....	
12,000	48,000	.005667	.001167	.....	.....	
12,250	49,000	.006600	.000933	.....	.....	
12,500	50,000	.008667	.002067	.....	.....	
12,750	51,000	.009833	.001166	.....	.....	
21,500	86,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,000
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.39*, ″.18

TUBE.

No. 5533.

Marks, $\overset{7407\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000700	.000367	----------	----------	
7,500	30,000	.001033	.000333	----------	----------	
8,750	35,000	.001200	.000167	0.	----------	
10,000	40,000	.001367	.000167	----------	----------	
10,500	42,000	.001433	.000066	0.	----------	
10,750	43,000	.001500	.000067	----------	----------	
11,000	44,000	.001567	.000067	----------	----------	
11,250	45,000	.001600	.000033	----------	----------	
11,500	46,000	.001633	.000033	----------	----------	
11,750	47,000	.001667	.000034	----------	----------	
12,000	48,000	.001700	.000033	----------	----------	
12,250	49,000	.001733	.000033	----------	----------	Elastic limit.
12,500	50,000	.001933	.000200	----------	----------	
12,750	51,000	.002567	.000634	----------	----------	
13,000	52,000	.003733	.001166	----------	----------	
13,250	53,000	.005333	.001600	----------	----------	
13,500	54,000	.007000	.001667	----------	----------	
22,230	88,920	----------	----------	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,920
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.15, ″.43*, ″.13

JACKET NO. 20.

No. 5386.

Marks, $\overset{10\ R\ 20\ J}{B\ T_1 O}$
Diameter, ″.564.
Sectional area, .25.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001367	.000200	.....	.....	
10,250	41,000	.001400	.000033	.....	.....	Elastic limit.
10,500	42,000	.002967	.001567	.001400	.001400	
10,750	43,000	.003567	.000600	.....	.....	
11,000	44,000	.004667	.001100	.....	.....	
11,250	45,000	.005767	.001100	.....	.....	
11,500	46,000	.007000	.001233	.....	.....	
11,750	47,000	.007833	.000833	.....	.....	
20,060	80,240	.1667	.158867	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,240
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2700
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.204
Reduction in area after rupture, per cent of original section		59.3
Position of rupture		1″.35 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.40*, ″26

JACKET NO. 20.

No. 5387.

Marks, $\overset{10\ R\ 20\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001000	.000333	----------	----------	
8,750	35,000	.001200	.000200	0.	----------	
10,000	40,000	.001333	.000133	----------	----------	
10,500	42,000	.001367	.000034	0.	----------	
10,750	43,000	.001400	.000033	----------	----------	
11,000	44,000	.001433	.000033	----------	----------	
11,250	45,000	.001467	.000034	----------	----------	
11,500	46,000	.001500	.000033	----------	----------	
11,750	47,000	.001533	.000033	----------	----------	
12,000	48,000	.001600	.000067	----------	----------	
12,250	49,000	.001633	.000033	----------	----------	
12,500	50,000	.001667	.000034	----------	----------	
12,750	51,000	.001733 .003267	.000066 .001534	----------	----------	Elastic limit.
13,000	52,000	.005000	.001733	----------	----------	
13,250	53,000	.006000	.001000	----------	----------	
13,500	54,000	.007200	.001200	----------	----------	
13,750	55,000	.008167	.000967	----------	----------	
14,000	56,000	.009500	.001333	----------	----------	
22,120	88,480	.1400	.1305	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	38,480
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch...	.2033
Elongation per inch under strain at elastic limit	do...	001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″34*, ″.16

JACKET.

No. 5393.

Marks, $\frac{6427\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000300	.000200	----------	----------	
5,000	20,000	.000633	.000333	----------	----------	
7,500	30,000	.000967	.000334	----------	----------	
8,750	35,000	.001100	.000133	0.	----------	
10,000	40,000	.001267	.000167	----------	----------	
10,500	42,000	.001333	.000066	0.	----------	
10,750	43,000	.001367	.000034	----------	----------	
11,000	44,000	.001400	.000033	----------	----------	
11,250	45,000	.001433	.000033	----------	----------	
11,500	46,000	.001467	.000034	----------	----------	
11,750	47,000	.001500	.000033	----------	----------	
12,000	48,000	.001567	.000067	----------	----------	
12,250	49,000	.001600	.000033	----------	----------	
12,500	50,000	.001633	.000033	----------	----------	
12,750	51,000	.001667	.000034	----------	----------	
13,000	52,000	.001700	.000033	----------	----------	
13,250	53,000	.001733	.000033	----------	----------	Elastic limit.
13,500	54,000	.002100	.000367	----------	----------	
13,750	55,000	.002967	.000867	----------	----------	
14,000	56,000	.003733	.000766	----------	----------	
14,250	57,000	.004833	.001100	----------	----------	
14,500	58,000	.005667	.000834	----------	----------	
24,590	98,360	.1300	.124333	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,360
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.66 from neck
Character of broken surface		silky, in part contains trace of granulation
Elongation of inch sections		″.14, ″.33*, ″.15

JACKET.

No. 5392.

Marks, $\frac{6427\ B_1}{M\ T^2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001800	.000033	.....	.....	Elastic limit.
13,500	54,000	.002100	.000300	.....	.....	
13,750	55,000	.003000	.000900	.....	.....	
14,000	56,000	.004167	.001167	.....	.....	
14,250	57,000	.005167	.001000	.....	.....	
14,500	58,000	.006167	.001000	.....	.....	
24,480	97,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,920
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1000
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		″.25 from neck
Character of broken surface		granular, radiating from a flaky spot at the circumference
Elongation of inch sections		″.12⁵, ″.11, ″.07

JACKET.

No. 5407.

Marks, $\overset{6771\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	.000033	0.	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	
13,000	52,000	.001833	.000066	.....	.....	Elastic limit.
13,250	53,000	.002133	.000300	.....	.....	
13,500	54,000	.003333	.001200	.....	.....	
13,750	55,000	.005000	.001667	.....	.....	
14,000	56,000	.005833	.000833	.....	.....	
14,250	57,000	.006833	.001000	.....	.....	
24,640	98,560	.1400	.133167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,560
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.16 from neck
Character of broken surface		dull, silky
Elongation of inch section		″.12, ″.19, ″.27*

JACKET.

No. 5406.

Marks, $\overset{6771\,B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001833	.000066	.....	.....	Elastic limit.
13,500	54,000	.002000	.000167	.....	.....	
13,750	55,000	.002833	.000833	.....	.....	
14,000	56,000	.004000	.001167	.....	.....	
14,250	57,000	.005000	.001000	.....	.....	
14,500	58,000	.006000	.001000	.....	.....	
24,510	98,040	.1300	.1240	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	98,040
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of stem.
Character of broken surface		silky
Elongation of inch sections		″.12, ″.32*, ″13

JACKET.

No. 5477.

Marks, $\frac{6839\ B_1}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001400	.000233	.....	.....	
10,500	42,000	.001533	.000133	.000067	.000067	Elastic limit.
10,750	43,000	.001667	.000134	.....	.....	
11,000	44,000	.002833	.001166	.....	.....	
11,250	45,000	.003733	.000900	.....	.....	
11,500	46,000	.004867	.001134	.....	.....	
11,750	47,000	.005700	.000833	.....	.....	
21,190	84,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,760
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.175
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.40*, ″.15, ″.11

JACKET.

No. 5476.

Marks, $\frac{6839\ B,}{M\ T_2\ M.}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001467	.000100	0.	.....	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12.000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	
12,500	50,000	.001800	.000067	.....	.....	
12,750	51,000	.001833	.000033	.....	.....	
13,000	52,000	.001867	.000034	.....	.....	Elastic limit.
13,250	53,000	.002200	.000333	.....	.....	
13,500	54,000	.004867	.002667	.....	.....	
13,750	55,000	.005767	.000900	.....	.....	
14,000	56,000	.006933	.001166	.....	.....	
14,250	57,000	.007800	.000867	.....	.....	
23,270	93,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,080
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.13, ″.35, ″.11

JACKET.

No. 5525.

Marks, $\frac{7178\ B_1}{B\ T_2\ M.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001233	.000166	.000033	.000033	
10,000	40,000	.001433	.000200	.....	.....	
10,500	42,000	.001500	.000067	.000033	0.	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001567	.000034	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001767	.000067	.....	.....	Elastic limit.
12,500	50,000	.001833	.000066	.....	.....	
		.002000	.000167	.....	.....	
12,750	51,000	.002433	.000433	.....	.....	
13,000	52,000	.004833	.002400	.....	.....	
13,250	53,000	.005600	.000767	.....	.....	
13,500	54,000	.006667	.001067	.....	.....	
23,480	93,920	.1400	.133333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,920
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.58 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.36*, ″.17

JACKET.

No. 5524.

Marks, $\frac{7178\ B_1}{M\ T_2\ M.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000200	.000067	.....	.....	
5,000	20,000	.000500	.000300	.....	.....	
7,500	30,000	.000867	.000367	.....	.....	
8,750	35,000	.001067	.000200	.000033	.000033	
10,000	40,000	.001233	.000166	.....	.....	
10,500	42,000	.001267	.000034	.000033	0.	
10,750	43,000	.001333	.000066	.....	.....	
11,000	44,000	.001400	.000067	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	Elastic limit.
12,500	50,000	.001800	.000233	.....	.....	
		.002533	.000733	.....	.....	
12,750	51,000	.003133	.000600	.....	.....	
13,000	52,000	.006733	.003600	.....	.....	
13,250	53,000	.007367	.000634	.....	.....	
13,500	54,000	.008333	.000966	.....	.....	
22,940	91,760	.1433	.134967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,760
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.30*, ″.19

TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES (STEMS 3″ LONG, ″.564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5379	Tube No. 17...	Outside.	45,000	79,560	4.3	4.8	Granular, radiating from a dull spot at the circumference.	Breech end.
5380	.....do	....do ...	48,000	84,760	21.6	49.7	Silky	Muzzle end.
5381	Tube No. 18...	....do ...	44,000	86,720	21.3	49.7	.....do	Breech end.
5382	.....do	....do ...	49,000	85,720	23.3	49.7	.....do	Muzzle end.
5391	Tube	....do ...	47,000	89,640	22.7	49.7	.....do	Breech end.
5390	.....do	Middle..	51,000	90,880	18.3	47.2	.....do	Muzzle end.
5469	.....do	....do ...	48,000	87,440	24.0	49.7	.....do	Breech end.
5468	.....do	....do ...	50,000	89,280	24.3	52.2	.....do	Muzzle end.
5475	.....do	....do ...	45,000	84,280	23.7	52.2	.....do	Breech end.
5474	.....do	....do ...	53,000	92,000	19.7	36.4	Silky, 60 per cent; granular, 40 per cent.	Muzzle end.
5479	.....do	....do ...	45,000	85,160	23.3	52.2	Silky	Breech end.
5478	.....do	....do ...	50,000	90,440	19.0	44.6	.....do	Muzzle end.
5530	.....do	....do ...	44,000	89,640	21.3	44.6	.....do	Do.
5534	.....do	....do ...	46,000	86,000	23.3	54.6	.....do	Breech end.
5533	.....do	....do ...	49,000	88,920	23.7	54.6	.....do	Muzzle end.
5386	Jacket No. 20..	Outside .	41,000	80,240	27.0	59.3	.....do	Breech end.
5387	.....do	....do ...	51,000	88,480	20.3	44.6	.....do	Muzzle end.
5393	Jacket.....	Middle..	53,000	98,360	20.7	36.4	Silky, in part granular.	Breech end.
5392	.....do	....do ...	53,000	97,920	10.0	11.6	Granular, radiating from spot in circumference.	Muzzle end.
5407	.....do	....do ...	52,000	98,560	19.3	41.9	Dull silky	Breech end.
5406	.....do	....do ...	53,000	98,040	19.0	47.2	Silky	Muzzle end.
5477	.....do	....do ...	42,000	84,760	22.0	52.2	.....do	Breech end.
5476	.....do	....do ...	52,000	93,080	19.7	49.7	.....do	Muzzle end.
5525	.....do	....do ...	49,000	93,920	22.7	44.6	.....do	Breech end.
5524	.....do	....do ...	49,000	91,760	21.3	47.2	.....do	Muzzle end.

12-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 5397.

Marks, $\frac{5964\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied load.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	.....	.....	
10,000	40,000	.001367	.000200	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	
11,250	45,000	.001600	.000067	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	Elastic limit.
11,750	47,000	.001767	.000134	.....	.....	
12,000	48,000	.002033	.000266	.....	.....	
12,250	49,000	.002333	.000300	.....	.....	
12,500	50,000	.002633	.000300	.....	.....	
12,750	51,000	.003267	.000634	.....	.....	
24,080	96,320	.1333	.130033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section ..... pounds.. 96,320
Elastic limit per square inch of original section ..... do... 46,000
Elongation per inch after rupture ..... inch.. .1900
Elongation per inch under strain at elastic limit ..... do... .001633
Reduction in diameter at point of rupture ..... do... ,104
Reduction in area after rupture, per cent of original section 33.5
Position of rupture ..... at middle of stem
Character of broken surface ..... silky, interspersed with granular metal at the circumference
Elongation of inch sections ..... ″.13, ″.31*, ″.13

TUBE.

No. 5396.

Marks, $\overset{5964\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	Elastic limit.
13,000	52,000	.002000	.000300	.....	.....	
13,250	53,000	.002367	.000367	.....	.....	
13,500	54,000	.003067	.000700	.....	.....	
13,750	55,000	.003700	.000633	.....	.....	
14,000	56,000	.004667	.000967	.....	.....	
24,180	96,720	.1200	.115333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,720
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1433
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		″.95 from neck
Character of broken surface		granular, radiating from a dull, flaky spot at the circumference. Opened a crack in the stem near the place of rupture.
Elongation of inch sections		″.18*, ″.14, ″.11

TUBE.

No. 5509.

Marks, $\frac{6030\ B_1}{B\ T_8\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000733	.000366	.....	.....	
7,500	30,000	.001100	.000367	0.	.....	
8,750	35,000	.001267	.000167	.000033	.000033	
10,000	40,000	.001467	.000200	.000033	0.	
10,250	41,000	.001533	.000066	.....	.....	
10,500	42,000	.001567	.000034	.....	.....	
10,750	43,000	.001600	.000033	.....	.....	
11,000	44,000	.001667	.000067	.....	.....	
11,250	45,000	.001700	.000033	.....	.....	Elastic limit.
11,500	46,000	.001867	.000167	.....	.....	
11,750	47,000	.002067	.000200	.....	.....	
12,000	48,000	.002633	.000566	.....	.....	
12,250	49,000	.003000	.000367	.....	.....	
12,500	50,000	.003867	.000867	.....	.....	
12,750	51,000	.004333	.000466	.....	.....	
13,000	52,000	.005333	.001000	.....	.....	
23,120	92,480	.1400	.134667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,480
Elastic limit per square inch of original section	do	45,000
Elongation per inch after rupture	inch	.1867
Elongation per inch under strain at elastic limit	do	.001700
Reduction in diameter at point of rupture	do	.104
Reduction in area after rupture, per centum of original section		33.5
Position of rupture		″.95 from neck
Character of broken surface		granular, 50 per cent; silky, 50 per cent; irregular surface
Elongation of inch sections		″.13, ″.14, ″.29*

TUBE.

No. 5508.

Marks, $\frac{6030\ B_1}{M\ T_8\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	.....	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	Elastic limit below 35,000 pounds per square inch.
8,750	35,000	.001333	.000300	.....	.....	
9,000	36,000	.001433	.000100	.....	.....	
9,250	37,000	.001500	.000067	.....	.....	
9,500	38,000	.001567	.000067	.....	.....	
9,750	39,000	.001633	.000066	.....	.....	
10,000	40,000	.001733	.000100	.....	.....	
10,250	41,000	.001900	.000167	.....	.....	
10,500	42,000	.002033	.000133	.....	.....	
10,750	43,000	.002200	.000167	.....	.....	
11,000	44,000	.002367	.000167	.....	.....	
11,250	45,000	.002900	.000533	.....	.....	
11,500	46,000	.004667	.001767	.....	.....	
11,750	47,000	.005233	.000566	.....	.....	
12,000	48,000	.006000	.000767	.....	.....	
12,250	49,000	.006667	.000667	.....	.....	
12,500	50,000	.007533	.000866	.....	.....	
22,380	89,520	.1600	.152467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,520
Elastic limit per square inch of original section	below 35,000 pounds per square inch	
Elongation per inch after rupture	inch..	.2367
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.17, ″.36*, ″.18

JACKET.

No. 5395.

Marks, $\frac{6336\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000333	.000266	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	Elastic limit.
12,250	49,000	.004167	.002467	.....	.....	
12,500	50,000	.005000	.000833	.....	.....	
12,750	51,000	.005433	.000433	.....	.....	
13,000	52,000	.006067	.000634	.....	.....	
13,250	53,000	.006667	.000600	.....	.....	
24,090	96,360	.1400	.133333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,360
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.55 from neck
Character of broken surface		silky, in part interspersed with granular metal
Elongation of inch sections		″.14, ″.31*, ″.15

JACKET.

No. 5394.

Marks, $\frac{6336\ B_1}{M\ T_3\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	....	.....	Elastic limit.
12,000	48,000	.002133	.000500	.....	.....	
12,250	49,000	.002667	.000534	.....	.....	
12,500	50,000	.004667	.002000	.....	.....	
12,750	51,000	.005333	.000666	.....	... .	
13,000	52,000	.005933	.000600	.....	.....	
23,960	95,840	.1333	.127367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,840
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.13, ″.33*, ″.15

JACKET NO. 10.

No. 5506.

Marks, $\begin{smallmatrix}12 & R_{10} & J\\ B & T_1 & O\end{smallmatrix}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001200	.000167	0.	.....	
10,000	40,000	.001400	.000200	.....	.....	
10,500	42,000	.001433	.000033	0.	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001800	.000067	.....	.....	
13,000	52,000	.001867	.000067	.....	.....	
13,250	53,000	.001933	.000066	.....	.....	Elastic limit.
13,500	54,000	.002333	.000400	.....	.....	
13,750	55,000	.003367	.001034	.....	.....	
14,000	56,000	.004833	.001466	.....	.....	
14,250	57,000	.006167	.001334	.....	.....	
14,500	58,000	.006800	.000633	.....	.....	
23,840	95,360	.1333	.1265	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,360
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	1967
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.28 from neck
Character of broken surface		granular, 50 per cent; silky, 50 per cent
Elongation of inch sections		″.23, ″.25*, ″.11

JACKET No. 10.

No. 5507.

Marks, $\frac{12\ R\ 10\ J.}{M\ T_1\ O.}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
8,750	35,000	.001233	.000200	.000033	.000033	
10,000	40,000	.001400	.000167	.....	.....	
10,500	42,000	.001467	.000067	.000033	0.	
10,750	43,000	.001500	.000033	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	
13,000	52,000	.001833	.000066	.....	.....	
13,250	53,000	.001900	.000067	.....	.....	Elastic limit.
13,500	54,000	.002000	.000100	.....	.....	
13,750	55,000	.002233	.000233	.....	.....	
14,000	56,000	.002433	.000200	.....	.....	
14,250	57,000	.004000	.001567	.....	.....	
14,500	58,000	.006000	.002000	.....	.....	
23,880	95,520	.1333	.1273	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,520
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001900
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.57 from neck
Character of broken surface		silky
Elongation of inch sections		″.15, ″.38*, ″.18

TABULATION OF TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLES (STEMS 3" LONG, ".564 DIAMETER).

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Pr. ct.*	*Pr. ct.*		
5397	Tube	Middle .	46,000	96,320	19	33.5	Silky, interspersed with granular metal at circumference.	Breech end.
5396	.....do	....do ...	51,000	96,720	14.3	21.4	Granular, radiating from dull flaky spot at circumference.	Muzzle end.
5509	.....do	....do ...	45,000	92,480	18.7	33.5	Granular 50 per cent, silky 50 per cent.	Breech end.
5508	.....do	....do ...	{Below 35,000}	89,520	23.7	44.6	Silky	Muzzle end.
5395	Jacket.....	....do ...	48,000	96,360	20	36.4	Silky, interspersed with granular metal.	Breech end.
5394	.....do	....do ...	47,000	95,840	20.3	44.6	Silky	Muzzle end.
5506	Jacket No. 10.	Outside.	53,000	95,360	19.7	39.2	Granular 50 per cent, silky 50 per cent.	Breech end.
5507	.....do	....do ...	53,000	95,520	23.7	49.7	Silky	Muzzle end.

RIFLE-BARREL STEEL, .30 CALIBER.

BESSEMER STEEL.

No. 5385.

Marks, 44.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
12,500	50,000	.001633	.000300	.....	.....	
13,500	54,000	.001767	.000134	.....	.....	
13,750	55,000	.001800	.000033	.....	.....	
14,000	56,000	.001867	.000067	.....	.....	
14,250	57,000	.001900	.000033	.....	.....	
14,500	58,000	.001933	.000033	.....	.....	
14,750	59,000	.001967	.000034	.....	.....	
15,000	60,000	.002000	.000033	.....	.....	
15,250	61,000	.002033	.000033	.....	.....	
15,500	62,000	.002067	.000034	.....	.....	
15,750	63,000	.002133	.000066	.....	.....	
16,000	64,000	.002200	.000067	.....	.....	
16,250	65,000	.002233	.000033	.....	.....	Elastic limit. Load fell.
15,000	60,000	.004333	.002100	.....	.....	
15,250	61,000	.005333	.001000	.....	.....	
15,500	62,000	.008667	.003334	.....	.....	
15,750	63,000	.009167	.000500	.....	.....	
16,000	64,000	.009733	.000566	.....	.....	
16,250	65,000	.010133	.000400	.....	.....	
16,500	66,000	.010833	.000700	.....	.....	
17,000	68,000	.012167	.001334	.....	.....	
17,500	70,000	.013667	.001500	.....	.....	
18,000	72,000	.015333	.001666	.....	.....	
19,000	76,000	.018667	.003334	.....	.....	
20,000	80,000	.021667	.003000	.....	.....	
21,000	84,000	.025667	.004000	.....	.....	
22,000	88,000	.030667	.005000	.....	.....	
23,000	92,000	.034433	.003766	.....	.....	
24,000	96,000	.041067	.006634	.....	.....	
25,000	100,000	.049000	.007933	.....	.....	
26,000	104,000	.0633	.0143	.....	.....	
27,000	108,000	.0767	.0134	.....	.....	
27,720	110,880	.1267	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	110,880
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		1″.6 from neck
Character of broken surface		fine granular with silky center
Elongation of inch sections		″.12, ″.25*, ″.13

CRUCIBLE STEEL.

No. 5383.

Marks, 43.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	Elastic limit.
11,000	44,000	.001733	.000333	.....	.....	
11,250	45,000	.001933	.000200	.....	.....	
11,500	46,000	.002133	.000200	.....	.....	
11,750	47,000	.002400	.000267	.....	.....	
12,000	48,000	.002733	.000333	.....	.....	
12,250	49,000	.003067	.000334	.....	.....	
12,500	50,000	.003600	.000533	.....	.....	
13,000	52,000	.004333	.000733	.....	.....	
13,500	54,000	.005467	.001134	.....	.....	
14,000	56,000	.007333	.001866	.....	.....	
14,500	58,000	.012333	.005000	.....	.....	
15,000	60,000	.013267	.000934	.....	.....	
15,500	62,000	.014667	.001400	.....	.....	
16,000	64,000	.016000	.001333	.....	.....	
16,500	66,000	.017933	.001933	.....	.....	
17,000	68,000	.019400	.001467	.....	.....	
17,500	70,000	.021667	.002267	.....	.....	
18,000	72,000	.023333	.001666	.....	.....	
18,500	74,000	.025667	.002334	.....	.....	
19,000	76,000	.028167	.002500	.....	.....	
19,500	78,000	.031333	.003166	.....	.....	
20,000	80.000	.034000	.002667	.....	.....	
20,500	82,000	.037333	.003333	.....	.....	
21,000	84,000	.042000	.004667	.....	.....	
21,500	86,000	.0500	.0080	.....	.....	
22,000	88,000	.0567	.0067	.....	.....	
22,500	90,000	.0667	.0100	.....	.....	
23,000	92,000	.0867	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,000
Elastic limit per square inch of original section	do	43,000
Elongation per inch after rupture	inch	.1900
Elongation per inch under strain at elastic limit	do	.001400
Reduction in diameter at point of rupture	do	.234
Reduction in area after rupture, per cent of original section		66.0
Position of rupture		1″.27 from neck
Character of broken surface		fine, silky; cup shaped
Elongation of inch sections		″.04, ″.16, ″.37*

CRUCIBLE STEEL.

DUPLICATE OF NO. 5383.

No. 5398.

Marks, 43 D.
Diameter, ″.564
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	.....	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.001867	.000200	.....	.....	
12,250	49,000	.002000	.000133	.....	.....	
12,500	50,000	.002267	.000267	.000467	.000467	
12,750	51,000	.002600	.000333	.....	.....	
13,000	52,000	.002867	.000267	.....	.....	
13,250	53,000	.003033	.000166	.....	.....	
13,500	54,000	.003500	.000467	.....	.....	
14,000	56,000	.004300	.000800	.....	.....	
14,500	58,000	.005200	.000900	.....	.....	
15,000	60,000	.006067	.000867	.....	.....	
15,500	62,000	.007000	.000933	.....	.....	
16,000	64,000	.008100	.001100	.....	.....	
16,500	66,000	.009500	.001400	.....	.....	
17,000	68,000	.010633	.001133	.....	.....	
17,500	70,000	.011967	.001334	.....	.....	
18,000	72,000	.013333	.001366	.....	.....	
18,500	74,000	.014600	.001267	.....	.....	
19,000	76,000	.016000	.001400	.....	.....	
19,500	78,000	.017500	.001500	.....	.....	
20,000	80,000	.019067	.001567	.....	.....	
20,500	82,000	.020967	.001900	.....	.....	
21,000	84,000	.022833	.001866	.....	.....	
21,500	86,000	.024767	.001934	.....	.....	
22,000	88,000	.027000	.002233	.....	.....	
22,500	90,000	.029167	.002167	.....	.....	
23,000	92,000	.031800	.002633	.....	.....	
23,500	94,000	.034333	.002533	.....	.....	
24,000	96,000	.0400	.005667	.....	.....	
24,500	98,000	.0467	.0067	.....	.....	
25,000	100,000	.0533	.0066	.....	.....	
26,000	104,000	.0667	.0134	.....	.....	
26,680	106,720	1133	.0466	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,720
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.95 from neck
Character of broken surface		fine silky; cup-shaped ends
Elongation of inch sections		″.35*, ″.12, ″.11

CRUCIBLE STEEL.

ANNEALED IN COAL FURNACE.

No. 5384.

Marks, 42_a.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001400	.000367	.000033	.000033	
10,250	41,000	.001433	.000033	.....	.....	Elastic limit.
10,500	42,000	.005333	.003900	.....	.....	
10,750	43,000	.008033	.002700	.....	.....	
11,000	44,000	.008933	.000900	.....	.....	
11,250	45,000	.009400	.000467	.....	.....	
11,500	46,000	.010000	.000600	.....	.....	
11,750	47,000	.011000	.001000	.....	.....	
12,000	48,000	.011500	.000500	.....	.....	
12,250	49,000	.012167	.000667	.....	.....	
12,500	50,000	.013067	.000900	.....	.....	
13,000	52,000	.014500	.001433	.....	.....	
13,500	54,000	.016200	.001700	.....	.....	
14,000	56,000	.018267	.002067	.....	.....	
14,500	58,000	.019733	.001466	.....	.....	
15,000	60,000	.021700	.001967	.....	.....	
15,500	62,000	.023833	.002133	.....	.....	
16,000	64,000	.026333	.002500	.....	.....	
16,500	66,000	.028333	.002000	.....	.....	
17,000	68,000	.031167	.002834	.....	.....	
17,500	70,000	.033833	.002666	.....	.....	
18,000	72,000	.036667	.002834	.....	.....	
18,500	74,000	.040667	.004000	.....	.....	
19,000	76,000	.0467	.006033	.....	.....	
20,000	80,000	.0567	.0100	.....	.....	
21,000	84,000	.0733	.0166	.....	.....	
22,000	88,000	.1033	.0300	.....	.....	
22,260	89,040	.1433	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,040
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″ from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		″.31*, ″.18, ″.12

CRUCIBLE STEEL.

No. 5471.

Marks, 51.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	----------	----------	
2,500	10,000	.000300	.000167	----------	----------	
5,000	20,000	.000667	.000367	----------	----------	
7,500	30,000	.001000	.000333	----------	----------	
10,000	40,000	.001333	.000333	.000000	.000000	
12,500	50,000	.001700	.000367	.000033	.000033	
14,500	58,000	.001967	.000267	----------	----------	
14,750	59,000	.002000	.000033	----------	----------	Elastic limit.
15,000	60,000	.003333	.001333	----------	----------	
						Load fell.
13,250	53,000	.004267	.000934	----------	----------	
13,500	54,000	.004500	.000233	----------	----------	
13,750	55,000	.006333	.001833	----------	----------	
14,000	56,000	.010667	.004334	----------	----------	
14,250	57,000	.011400	.000733	----------	----------	
14,500	58,000	.011833	.000433	----------	----------	
14,750	59,000	.012267	.000434	----------	----------	
15,000	60,000	.013333	.001166	----------	----------	
15,500	62,000	.014867	.001534	----------	----------	
16,000	64,000	.017000	.002133	----------	----------	
16,500	66,000	.019000	.002000	----------	----------	
17,000	68,000	.021000	.002000	----------	----------	
17,500	70,000	.023433	.002433	----------	----------	
18,000	72,000	.025600	.002167	----------	----------	
18,500	74,000	.028000	.002400	----------	----------	
19,000	76,000	.030667	.002667	----------	----------	
19,500	78,000	.034667	.004000	----------	----------	
20,000	80,000	.037667	.003000	----------	----------	
21,000	84,000	.0467	.009033	----------	----------	
22,000	88,000	.0600	.0133	----------	----------	
23,000	92,000	.0800	.0200	----------	----------	
23,790	95,160	.1400	.0600	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,160
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.00 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.13, ″.18, ″.26*

CRUCIBLE STEEL.

No. 5480.

Marks, 52.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	.....	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001000	.000300	.....	.....	
10,000	40,000	.001367	.000367	.....	.....	
11,250	45,000	.001567	.000200	.....	.....	
12,500	50,000	.001700	.000133	.....	.....	
15,000	60,000	.002100	.000400	.....	.....	
17,000	68,000	.002333	.000233	.....	.....	Elastic limit. Load fell.
15,750	63,000	.006333	.004000	.....	.....	
16,000	64,000	.009000	.002667	.....	.....	
16,250	65,000	.010000	.001000	.....	.....	
16,500	66,000	.010567	.000567	.....	.....	
16,750	67,000	.011000	.000433	.....	.....	
17,000	68,000	.011933	.000933	.....	.....	
17,250	69,000	.012500	.000567	.....	.....	
17,500	70,000	.013600	.001100	.....	.....	
18,000	72,000	.015400	.001800	.....	.....	
18,500	74,000	.016900	.001500	.....	.....	
19,000	76,000	.018000	.001100	.....	.....	
19,500	78,000	.020333	.002333	.....	.....	
20,000	80,000	.022467	.002134	.....	.....	
21,000	84,000	.0300	.007533	.....	.....	
22,000	88,000	.0333	.0033	.....	.....	
23,000	92,000	.0400	.0067	.....	.....	
24,000	96,000	.0500	.0100	.....	.....	
25,000	100,000	.0633	.0133	.....	.....	
26,000	104,000	.0933	.0300	.....	.....	
26,360	105,440	.1267	.0334	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	105,440
Elastic limit per square inch of original section	do...	68,000
Elongation per inch after rupture	inch..	.1300
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		1″.65 from neck
Character of broken surface		fine granular, dull silky center
Elongation of inch sections		″.12, ″.17*, ″.10

CRUCIBLE STEEL.

No. 5483.

Marks, 55.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000700	.000400	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
10,000	40,000	.001400	.000333	0.	.....	
12,500	50,000	.001767	.000367	.....	.....	
15,000	60,000	.002200	.000433	.000100	.000100	Elastic limit.
15,250	61,000	.003200	.001000	.....	.....	
15,500	62,000	.006333	.003133	.....	.....	
15,750	63,000	.006667	.000334	.....	.....	
16,000	64,000	.007267	.000600	.....	.....	
16,250	65,000	.007667	.000400	.....	.....	
16,500	66,000	.008200	.000533	.....	.....	
16,750	67,000	.008867	.000667	.....	.....	
17,000	68,000	.009333	.000466	.....	.....	
17,500	70,000	.0100	.000667	.....	.....	
18,500	74,000	.0133	.0033	.....	.....	
19,500	78,000	.0167	.0034	.....	.....	
20,500	82,000	.0200	.0033	.....	.....	
21,500	86,000	.0200+	.0000+	.....	.....	
22,500	90,000	.0233	.0033	.....	.....	
23,500	94,000	.0267	.0034	.....	.....	
24,500	98,000	.0300	.0033	.....	.....	
25,500	102,000	.0333	.0033	.....	.....	
26,500	106,000	.0400	.0067	.....	.....	
27,500	110,000	.0433	.0033	.....	.....	
28,500	114,000	.0533	.0100	.....	.....	
29,500	118,000	.0633	.0100	.....	.....	
30,500	122,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	122,000
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture	inch..	.09000
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.8
Position of rupture		″.35 from neck
Character of broken surface		fine granular; two small, dull gray eccentric spots, each about ″.05 diameter.
Elongation of inch sections		″.11*, ″.09, ″.07

NICKEL STEEL.

INGOT NO. 1, SPECIALLY TREATED.

No. 5399.

Marks, 45.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
12,500	50,000	.001633	.000300	.....	.....	
15,000	60,000	.001967	.000334	0.	.....	
17,500	70,000	.002333	.000366	0.	.....	
20,000	80,000	.002667	.000334	0.	.....	
22,500	90,000	.003033	.000366	0.	.....	
22,750	91,000	.003067	.000034	.....	.....	
23,000	92,000	.003100	.000033	.....	.....	Elastic limit. Load fell.
21,250	85,000	.004367	.001267	.....	.....	
21,500	86,000	.004600	.000233	.....	.....	
22,000	88,000	.006667	.002067	.....	.....	
22,500	90,000	.023667	.017000	.....	.....	
23,000	92,000	.028667	.005000	.....	.....	
23,500	94,000	.033667	.005000	.....	.....	
24,000	96,000	.040167	.006500	.....	.....	
24,500	98,000	.0500	.009833	.....	.....	
25,000	100,000	.0600	.0100	.....	.....	
25,500	102,000	.0767	.0167	.....	.....	
25,890	103,560	.1133	.0366	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,560
Elastic limit per square inch of original section	do...	92,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.003100
Reduction in diameter at point of rupture	do...	.224
Reduction in area after rupture, per cent of original section		63.7
Position of rupture		1″.67 from neck
Character of broken surface		fine silky, serrated, cup-shaped ends
Elongation of inch sections		″.14, ″.41*, ″.11

NICKEL STEEL.

INGOT NO. 1, SIMPLY ANNEALED.

No. 5400.

Marks, 46.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001633	.000333	.....	.....	
15,000	60,000	.001967	.000334	.....	.....	
16,500	66,000	.002167	.000200	.....	.....	
16,750	67,000	.002200	.000033	.....	.....	Elastic limit. Load fell.
14,750	59,000	.004033	.001833	.....	.....	
15,000	60,000	.004200	.000167	.....	.....	
15,250	61,000	.005667	.001467	.....	.....	
15,500	62,000	.013667	.008000	.....	.....	
15,750	63,000	.015333	.001666	.....	.....	
16,000	64,000	.016333	.001000	.....	.....	
16,500	66,000	.019333	.003000	.....	.....	
17,000	68,000	.022000	.002667	.....	.....	
17,500	70,000	.025833	.003833	.....	.....	
18,000	72,000	.030000	.004167	.....	.....	
18,500	74,000	.034333	.004333	.....	.....	
19,000	76,000	.039000	.004667	.....	.....	
19,500	78,000	.044667	.005667	.....	.....	
20,000	80,000	.0567	.012033	.....	.....	
20,500	82,000	.0633	.0066	.....	.....	
21,000	84,000	.0733	.0100	.....	.....	
21,500	86,000	.0933	.0200	.....	.....	
21,930	87,720	.1333	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,720
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch...	.2167
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.12 from neck
Character of broken surface		silky; longitudinal cavity near axis of specimen ″.05x″.02; length not known.
Elongation of inch sections		″.33*, ″.21, ″.11

NICKEL STEEL.

INGOT NO. 2, SPECIALLY TREATED.

No. 5401.

Marks, 47.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001667	.000367	.....	.....	
15,000	60,000	.002000	.000333	0.	.....	
17,500	70,000	.002333	.000333	.....	.....	
20,000	80,000	.002667	.000334	0.	.....	
21,000	84,000	.002800	.000133	.....	.....	Elastic limit.
21,250	85,000	.003000	.000200	.....	.....	
						Load fell.
20,500	82,000	.003500	.000500	.....	.....	
20,750	83,000	.004333	.000833	.....	.....	
21,000	84,000	.015667	.011334	.....	.....	
21,250	85,000	.017000	.001333	.....	.....	
21,500	86,000	.018333	.001333	.....	.....	
22,000	88,000	.023333	.005000	.....	.....	
22,500	90,000	.027000	.003667	.....	.....	
23,000	92,000	.032500	.005500	.....	.....	
23,500	94,000	.037000	.004500	.....	.....	
24,000	96,000	.0467	.0097	.....	.....	
24,500	98,000	.0533	.0066	.....	.....	
25,000	100,000	.0633	.0100	.....	.....	
25,500	102,000	.0800	.0167	.....	.....	
25,810	103,240	.1133	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,240
Elastic limit per square inch of original section	do...	84,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.002800
Reduction in diameter at point of rupture	do...	.234
Reduction in area after rupture, per cent of original section		65.8
Position of rupture		1″.13 from neck
Character of broken surface		fine, silky, serrated; cup-shaped ends
Elongation of inch sections		″.10, ″.18, ″.37*

NICKEL STEEL.

INGOT NO. 2, SIMPLY ANNEALED.

No. 5402.

Marks, 48.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000200	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001667	.000367	.....	.....	
14,500	58,000	.001867	.000200	.....	.....	Elastic limit.
						Load fell.
13,750	55,000	.004000	.002133	.....	.....	
14,000	56,000	.005667	.001667	.....	.....	
14,250	57,000	.008500	.002833	.....	.....	
14,500	58,000	.009500	.001000	.....	.....	
14,750	59,000	.010333	.000833	.....	.....	
15,000	60,000	.012667	.002334	.....	.....	
15,500	62,000	.013933	.001266	.....	.....	
16,000	64,000	.015833	.001900	.....	.....	
16,500	66,000	.018333	.002500	.....	.....	
17,000	68,000	.021167	.002834	.....	.....	
17,500	70,000	.023333	.002166	.....	.....	
18,000	72,000	.026333	.003000	.....	.....	
18,500	74,000	.029333	.003000	.....	.....	
19,000	76,000	.033500	.004167	.....	.....	
19,500	78,000	.036667	.002167	.....	.....	
20,000	80,000	.040667	.004000	.....	.....	
20,500	82,000	.0467	,006033	.....	.....	
21,000	84,000	.0567	.0100	.....	.....	
21,500	86,000	.0633	.0066	.....	.....	
22,000	88,000	.0700	.0067	.....	.....	
22,500	90,000	.0867	.0167	.....	.....	
23,000	92,000	.1167	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,000
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.194
Reduction in area after rupture, per cent of original section		57.0
Position of rupture		″.85 from neck
Character of broken surface		fine, silky; cup-shaped ends
Elongation of inch sections		″.41*, ″.14, ″.10

NICKEL STEEL.

No. 5520.

Marks, 58–2.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000300	.000200	----------	----------	
5,000	20,000	.000633	.000333	----------	----------	
7,500	30,000	.001000	.000367	----------	----------	
10,000	40,000	.001367	.000367	0.	----------	
12,500	50,000	.001667	.000300	----------	----------	
15,000	60,000	.002000	.000333	0.	----------	
16,750	67,000	.002200	.000200	----------	----------	
17,000	68,000	.002233	.000033	----------	----------	Elastic limit.
17,250	69,000	.005600	.003367	----------	----------	
						Load fell.
16,500	66,000	.005733	.000133	----------	----------	
16,750	67,000	.006367	.000634	----------	----------	
17,000	68,000	.007000	.000633	----------	----------	
17,250	69,000	.007400	.000400	----------	----------	
17,500	70,000	.008000	.000600	----------	----------	
18,000	72,000	.009000	.001000	----------	----------	
18,500	74,000	.010000	.001000	----------	----------	
19,000	76,000	.011067	.001067	----------	----------	
19,500	78,000	.012167	.001100	----------	----------	
20,000	80,000	.014100	.001933	----------	----------	
21,000	84,000	.016000	.001900	----------	----------	
22,000	88,000	.018900	.002900	----------	----------	
23,000	92,000	.020667	.001767	----------	----------	
24,000	96,000	.024000	.003333	----------	----------	
25,000	100,000	.027667	.003667	----------	----------	
26,000	104,000	.030167	.002500	----------	----------	
27,000	108,000	.034667	.004500	----------	----------	
28,000	112,000	.040000	.005333	----------	----------	
29,000	116,000	.046667	.006667	----------	----------	
30,000	120,000	.055000	.008333	----------	----------	
31,000	124,000	.0733	.0183	----------	----------	
31,580	126,320	.1067	.0334	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	126,320
Elastic limit per square inch of original section	do	68,000
Elongation per inch after rupture	inch	.1333
Elongation per inch under strain at elastic limit	do	.002233
Reduction in diameter at point of rupture	do	.054
Reduction in area after rupture, per cent of original section	do	18.3
Position of rupture		1″.19 from neck
Character of broken surface		fine granular, radiating from a dull spot at the circumference where a punch mark defined the first inch section.
Elongation of inch sections		″.13, ″.17*, ″.10

NICKEL STEEL.

No. 5521.

Marks, 59–3.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000300	.000200	----------	----------	
5,000	20,000	.000633	.000533	----------	----------	
7,500	30,000	.000967	.000334	----------	----------	
10,000	40,000	.001300	.000333	0.	----------	
12,500	50,000	.001667	.000367	----------	----------	
15,000	60,000	.002000	.000333	0.	----------	
16,500	66,000	.002300	.000300	----------	----------	
16,750	67,000	.002333	.000033	----------	----------	
17,000	68,000	.002367	.000034	----------	----------	
17,250	69,000	.002433	.000066	----------	----------	
17,500	70,000	.002467	.000034	0.	----------	
17,750	71,000	.002533	.000066	----------	----------	
18,000	72,000	.002567	.000034	----------	----------	
18,250	73,000	.002600	.000033	----------	----------	
18,500	74,000	.002633	.000033	----------	----------	
18,750	75,000	.002667	.000034	----------	----------	
19,000	76,000	.002733	.000066	----------	----------	Elastic limit.
19,250	77,000	.002867	.000134	----------	----------	
		.006000	.003133	----------	----------	
19,500	78,000	.006600	.000600	----------	----------	
19,750	79,000	.007033	.000433	----------	----------	
20,000	80,000	.007600	.000567	----------	----------	
20,500	82,000	.008600	.001000	----------	----------	
21,000	84,000	.009000	.000400	----------	----------	
21,500	86,000	.010000	.001000	----------	----------	
22,000	88,000	.011000	.001000	----------	----------	
23,000	92,000	.013000	.002000	----------	----------	
24,000	96,000	.015167	.002167	----------	----------	
25,000	100,000	.017167	.002000	----------	----------	
26,000	104,000	.019200	.002033	----------	----------	
27,000	108,000	.021667	.002467	----------	----------	
28,000	112,000	.024333	.002666	----------	----------	
29,000	116,000	.026967	.002634	----------	----------	
30,000	120,000	.029333	.002366	----------	----------	
31,000	124,000	.0333	.003967	----------	----------	
32,000	128,000	.0400	.0067	----------	----------	
33,000	132,000	.0467	.0067	----------	----------	
34,000	136,000	.0533	.0066	----------	----------	
35,000	140,000	.0700	.0167	----------	----------	
35,340	141,360	.0900	.0200	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	141,360
Elastic limit per square inch of original section	do	76,000
Elongation per inch after rupture	inch	.0900
Elongation per inch under strain at elastic limit	do	.002733
Reduction in diameter at point of rupture	do	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		1″.23 from neck
Character of broken surface		fine granular, radiating from center punch mark defining inch section
Elongation of inch sections		″.09, ″.10, ″.08

NICKEL CRUCIBLE STEEL, OIL-TEMPERED AND ANNEALED.

No. 5481.

Marks, 53.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001033	.000333	.....	.....	
10,000	40,000	.001400	.000367	0.	.....	
12,500	50,000	.001733	.000333	.....	.....	
15,000	60,000	.002067	.000334	0.	.....	
17,500	70,000	.002400	.000333	0.	.....	
20,000	80,000	.002767	.000367	0.	.....	
22,500	90,000	.003100	.000333	.000033	.000033	
23,500	94,000	.003233	.000133	.....	.....	
23,750	95,000	.003267	.000034	.....	.....	Elastic limit.
24,000	96,000	.003467	.000200	.....	.....	
24,250	97,000	.003733	.000266	.....	.....	
24,500	98,000	.006000	.002267	.....	.....	
24,750	99,000	.008000	.002000	.....	.....	
25,000	100,000	.0100	.0020	.....	.....	
26,000	104,000	.0200	.0100	.....	.....	
27,000	108,000	.0267	.0067	.....	.....	
28,000	112,000	.0367	.0100	.....	.....	
29,000	116,000	.0500	.0133	.....	.....	
30,000	120,000	.0800	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,000
Elastic limit per square inch of original section	do...	95,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.003267
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		″.90 from neck
Character of broken surface		fine silky; cup-shaped ends
Elongation of inch sections		″.36*, ″.10, ″.06

NICKEL CRUCIBLE STEEL, OIL TEMPERED AND ANNEALED.

No. 5482.

Marks, 54.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000300	.000167	----------	----------	
5,000	20,000	.000667	.000167	----------	----------	
7,500	30,000	.001033	.000366	----------	----------	
10,000	40,000	.001333	.000300	0.	----------	
12,500	50,000	.001667	.000334	----------	----------	
15,000	60,000	.002000	.000333	----------	----------	
17,500	70,000	.002367	.000367	0.	----------	
20,000	80,000	.002700	.000333	0.	----------	
22,500	90,000	.003067	.000367	0.	----------	
23,000	92,000	.003167	.000100	----------	----------	
23,250	93,000	.003233	.000066	----------	----------	Elastic limit.
23,500	94,000	.003367	.000134	----------	----------	
23,750	95,000	.003633	.000266	.000333	.000333	
24,000	96,000	.004167	.000534	----------	----------	
24,250	97,000	.005500	.001333	----------	----------	
24,500	98,000	.0100	.0045	----------	----------	
25,000	100,000	.0167	.0067	----------	----------	
26,000	104,000	.0267	.0100	----------	----------	
27,000	108,000	.0333	.0066	----------	----------	
28,000	112,000	.0433	.0100	----------	----------	
29,000	116,000	.0600	.0167	----------	----------	
29,920	119,680	.1000	.0400	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	119,680
Elastic limit per square inch of original section	do	93,000
Elongation per inch after rupture	inch	.1833
Elongation per inch under strain at elastic limit	do	.003233
Reduction in diameter at point of rupture	do	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1″ from neck
Character of broken surface		fine silky; cup-shaped ends
Elongation of inch sections		″.08, ″.12, ″.35*

No. 5403.

Marks, 49.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3.″

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
12,500	50,000	.001667	.000334	.....	.....	
15,000	60,000	.002000	.000333	0.	.....	
16,250	65,000	.002133	.000133	.....	.....	Elastic limit.
16,500	66,000	.002967	.000834	.....	.....	
						Load fell.
16,000	64,000	.005500	.002533	.....	.....	
16,250	65,000	.007033	.001533	.....	.....	
17,000	68,000	.008767	.001734	.....	.....	
17,500	70,000	.010333	.001566	.....	.....	
18,000	72,000	.011667	.001334	.....	.....	
18,500	74,000	.013000	.001333	.....	.....	
19,000	76,000	.014500	.001500	.....	.....	
19,500	78,000	.016167	.001667	.....	.....	
20,000	80,000	.017500	.001333	.....	.....	
20,500	82,000	.019000	.001500	.....	.....	
21,000	84,000	.020667	.001667	.....	.....	
21,500	86,000	.022333	.001666	.....	.....	
22,000	88,000	.024333	.002000	.....	.....	
22,500	90,000	.025667	.001334	.....	.....	
23,000	92,000	.028333	.002666	.....	.....	
23,500	94,000	.030667	.002334	.....	.....	
24,000	96,000	.033000	.002333	.....	.....	
24,500	98,000	.035333	.002333	.....	.....	
25,000	100,000	.038333	.003000	.....	.....	
26,000	104,000	.0467	.008367	.....	.....	
27,000	108,000	.0567	.0100	.....	.....	
28,000	112,000	.0767	.0200	.....	.....	
28,620	114,480	.1133	.0366	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	114,480
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain of elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1.″55 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.11, ″.28, .″.14

No. 5526.

METAL AS RECEIVED FROM THE MANUFACTURERS.

Marks, 49.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000733	.000366	.....	.....	
7,500	30,000	.001067	.000334	.....	.....	
10,000	40,000	.001433	.000366	0.	.....	
12,500	50,000	.001800	.000367	.....	.....	
15,000	60,000	.002133	.000333	.000033	.000033	
17,000	68,000	.002400	.000267	.....	.....	
17,250	69,000	.002467	.000067	.....	.....	Elastic limit. Load fell.
16,500	66,000	.003700	.001233	.....	.....	
16,750	67,000	.004167	.000467	.....	.....	
17,000	68,000	006200	.002033	.....	.....	
17,250	69,000	.006833	.000633	.....	.....	
17,500	70,000	.007567	.000734	.....	.....	
17,750	71,000	.008000	.000433	.....	.....	
18,000	72,000	.009000	.001000	.....	.....	
19,000	76,000	.0133	.0043	.....	.....	
20,000	80,000	.0167	.0034	.....	.....	
21,000	84,000	.0200	.0033	.....	.....	
22,000	88,000	.0233	.0033	.....	.....	
23,000	92,000	.0267	.0034	.....	.....	
24,000	96,000	.0300	.0033	.....	.....	
25,000	100,000	.0333	.0033	.....	.....	
26,000	104,000	.0367	.0034	.....	.....	
27,000	108,000	.0433	.0066	.....	.....	
28,000	112,000	.0500	.0067	.....	.....	
29,000	116,000	.0633	.0133	.....	.....	
30,000	120,000	.0900	.0267	.....	.....	
30,120	120,480	.1100	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,480
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002467
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		at middle of stem
Character of broken surface		fine silky, with trace of granulation
Elongation of inch sections		″.12, ″.29*, ″.11

No. 5527.

METAL AS RECEIVED FROM THE MANUFACTURERS.

Marks, 49.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
13,000	65,000	.002233	.000166	.....	.....	
14,000	70,000	.002433	.000200	0.	.....	
14,200	71,000	.002500	.000067	.....	.....	Elastic limit.
14,400	72,000	.002633	.000133	.....	.....	
						Load fell.
14,000	70,000	.003200	.000567	.....	.....	
14,200	71,000	.0048 3	.001633	.....	.....	
14,400	72,000	.006733	.001900	.....	.....	
14,600	73,000	.007133	.000400	.....	.....	
14,800	74,000	.007667	.000534	.....	.....	
15,000	75,000	.008200	.000533	.....	.....	
15,200	76,000	.009000	.000800	.005933	.005933	
200	1,000	.005933	.....	.....	.....	
2,000	10,000	.006267	.....	.....	.....	
4,000	20,000	.006633	.....	.....	.....	
6,000	30,000	.007000	.....	.....	.....	
8,000	40,000	.007367	.....	.....	.....	
10,000	50,000	.007800	.....	.....	.....	
12,000	60,000	.008233	.....	.....	.....	
10,000	50,000	.007867	.....	.....	.....	
8.000	40,000	.007500	.....	.....	.....	
6,000	30,000	.007133	.....	.....	.....	
4,000	20,000	.006767	.....	.....	.....	
2,000	10,000	.006367	.....	.....	.....	
200	1,000	.005967	.....	.....	.....	
16.000	80,000	.0133	.0043	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	0267	.0034	.....	.....	
20,000	100.000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0500	.0067	.....	.....	
24,000	120,000	.0633	.0133	.....	.....	
24,800	124,000	.0867	.0234	.....	.....	
24,910	124,550	.1000	.0133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	124,550
Elastic limit per square inch of original section	do	71,000
Elongation per inch after rupture	inch	.1633
Elongation per inch under strain at elastic limit	do	.002500
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.23 from neck
Character of broken surface		fine silky, with trace of granulation
Elongation of inch sections		″.10, ″.17, ″.22*

No. 5528.

Rolled into Barrel and Cooled in Air.

Marks, 49 A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000333	.000233	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001733	.000366	0.	.....	
12,000	60,000	.002067	.000334	.....	.....	
14,000	70,000	.002467	.000400	0.	.....	
14,200	71,000	.002533	.000066	.....	.....	Elastic limit. Load fell.
13,800	69,000	.003033	.000500	.....	.....	
14,000	70,000	.003833	.000800	.....	.....	
14,200	71,000	.005700	.001867	.....	.....	
14,400	72,000	.006600	.000900	.....	.....	
14,600	73,000	.007300	.000700	.....	.....	
14,800	74,000	.007833	.000533	.....	.....	
15,000	75,000	.008333	.000500	.....	.....	
15,200	76,000	.008833	.000500	.....	.....	
16,000	80,000	.0133	.004467	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0400	.0033	.....	.....	
23,200	116,000	.0467	.0067	.....	.....	
24,000	120,000	.0600	.0133	.....	.....	
24,800	124,000	.0867	.0267	.....	.....	
24,870	124,350	.1000	.0133	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	124,350
Elastic limit per square inch of original section	do	71,000
Elongation per inch after rupture	inch	.1467
Elongation per inch under strain at elastic limit	do	.002533
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		″.95 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.09, ″.11, ″.24*

No. 5529.

Rolled, and Annealed in Charcoal.

Marks, 49 C.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002067	.000334	.....	.....	
13,200	66,000	.002300	.000233	.....	.....	
13,400	67,000	.002367	.000067	.....	.....	Elastic limit. Load fell
12,800	64,000	.003533	.001166	.....	.....	
13,000	65,000	.005300	.001767	.....	.....	
13,200	66,000	.006533	.001233	.....	.....	
13,400	67,000	.007167	.000634	.....	.....	
13,600	68,000	.007867	.000700	.....	.....	
13,800	69,000	.008600	.000733	.....	.....	
14,000	70,000	.009067	.000467	.....	.....	
15,200	76,000	.0133	.004233	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0400	.0067	.....	.....	
21,600	108,000	.0467	.0067	.....	.....	
22,400	112,000	.0567	.0100	.....	.....	
23,200	116,000	.0700	.0133	.....	.....	
23,620	118,100	.1100	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,100
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1600
Elongation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.1 from neck
Character of broken surface		fine granular, silky center
Elongation of inch sections		″.23*, ″.15, ″.10

No. 5523.

Marks, 49 P.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.000967	.000300	.....	.....	
8,000	40,000	.001300	.000333	0.	.....	
10,000	50,000	.001633	.000333	.....	.....	
12,000	60,000	.002000	.000367	.....	.....	
13,000	65,000	.002200	.000200	.....	.....	
13,200	66,000	.002233	.000033	.....	.....	Elastic limit.
13,400	67,000	.002367	.000134	.....	.....	
						Load fell.
12,800	64,000	.003033	.000666	.....	.....	
13,000	65,000	.003167	.000134	.....	.....	
13,200	66,000	.003800	.000633	.....	.....	
13,400	67,000	.006000	.002200	.....	.....	
13,600	68,000	.006733	.000733	.....	.....	
13,800	69,000	.007400	.000667	.....	.....	
14,000	70,000	.008167	.000767	.....	.....	
15,200	76,000	.0133	.005133	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0367	.0034	.....	.....	
21,600	108,000	.0433	.0066	.....	.....	
22,400	112,000	.0500	.0067	.....	.....	
23,200	116,000	.0633	.0133	.....	.....	
24,000	120,000	.1100	.0467	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	120,000
Elastic limit per square inch of original section	do	66,000
Elongation per inch after rupture	inch	.1433
Elongation per inch under strain at elastic limit	do	.002233
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		″.7 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.26*, ″.09, ″.08

No. 5470.

Marks, 50.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000333	.000200	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001000	.000333	----------	----------	
10,000	40,000	.001367	.000367	0.	----------	
10,250	41,000	.001400	.000033	----------	----------	
10,500	42,000	.001433	.000033	----------	----------	
10,750	43,000	.001467	.000034	----------	----------	
11,000	44,000	.001500	.000033	----------	----------	
11,250	45,000	.001533	.000033	----------	----------	
11,500	46,000	.001567	.000034	----------	----------	Elastic limit.
11,750	47,000	.001833	.000266	----------	----------	
12,000	48,000	.002033	.000200	----------	----------	
12,250	49,000	.002400	.000367	----------	----------	
12,500	50,000	.002633	.000233	.000733	.000733	
12,750	51,000	.003000	.000367	----------	----------	
13,000	52,000	.003300	.000300	----------	----------	
13,250	53,000	.003567	.000267	----------	----------	
13,500	54,000	.004000	.000433	----------	----------	
14,000	56,000	.004833	.000833	----------	----------	
14,500	58,000	.005933	.001100	----------	----------	
15,000	60,000	.006667	.000734	----------	----------	
15,500	62,000	.008000	.001333	----------	----------	
16,000	64,000	.009000	.001000	----------	----------	
16,500	66,000	.010233	.001233	----------	----------	
17,000	68,000	.011500	.001267	----------	----------	
17,500	70,000	.013000	.001500	----------	----------	
18,000	72,000	.014433	.001433	----------	----------	
18,500	74,000	.015733	.001300	----------	----------	
19,000	76,000	.017367	.001634	----------	----------	
19,500	78,000	.019000	.001633	----------	----------	
20,000	80,000	.020967	.001967	----------	----------	
21,000	84,000	.0233	.002333	----------	----------	
22,000	88,000	.0267	.0034	----------	----------	
23,000	92,000	.0333	.0066	----------	----------	
24,000	96,000	.0400	.0067	----------	----------	
25,000	100,000	.0567	.0167	----------	----------	
25,930	103,720	.1067	.0500	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	103,720
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.46 from neck
Character of broken surface		silky
Elongation of inch sections		″.11,″.29*,″.14

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL (LENGTH OF STEMS 3″).

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Remarks.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″ ″	
5385	44	.564	.25	65,000	110,880	16.7	27.6	Fine granular, with silky center	.12, .25*, .13	
5383	43	.564	.25	43,000	92,000	19.0	66.0	Fine silky, cup shaped	.04, .16, .37*	
5398	43 D	.564	.25	47,000	106,720	19.3	52.2	do	.35*, .12, .11	
5384	42 A	.564	.25	41,000	89,040	20.0	36.4	Silky, with trace of granulation	.31*, .18, .12	Annealed in coal furnace.
5471	51	.564	.25	59,000	95,160	19.0	33.5	Fine silky	.13, .18, .26*	
5480	52	.564	.25	68,000	105,440	13.0	15.0	Fine granular, dull silky center	.12, .17*, .10	
5483	55	.564	.25	60,000	122,000	9.0	11.8	Fine granular. Two small dull gray eccentric spots, each about ″.05 diameter.	.11*, .09, .07	
5399	45	.564	.25	92,000	103,560	22.0	63.7	Fine silky, serrated, cup-shaped ends	.14, .41*, .11	Nickel steel; ingot No. 1 specially treated.
5400	46	.564	.25	67,000	87,720	21.7	47.2	Silky. Longitudinal cavity near axis of specimen ″.05 by ″.02, length not known.	.33*, .21, .11	Nickel steel; ingot No. 1 simply annealed.
5401	47	.564	.25	84,000	103,240	21.7	65.8	Fine silky, serrated, cup shaped	.10, .18, .37*	Nickel steel; ingot No. 2 specially treated.
5402	48	.564	.25	58,000	92,000	21.7	57.0	Fine silky, cup shaped	.41*, .14, .10	Nickel steel; ingot No. 2 simply annealed.
5520	58–2	.564	.25	68,000	126,320	13.3	18.3	Fine granular, radiating from a dull spot at the circumference, where a punch mark defined the first inch section.	.13, .17*, .10	Nickel steel.
5521	59–3	.564	.25	76,000	141,360	9.0	11.6	Fine granular, radiating from center punch mark defining inch section.	.09*, .10*, .08	Do.
5481	53	.564	.25	95,000	120,000	17.3	54.6	Fine silky, cup shaped	.36*, .10, .06	Nickel steel; oil tempered and annealed.
5482	54	.564	.25	93,000	119,680	18.3	54.6	do	.08, .12, .35*	
5403	49	.564	.25	65,000	114,480	17.7	33.5	Silky, interspersed with fine granulation	.11, .28*, .14	
5526	49	.564	.25	69,000	120,480	17.3	39.2	Fine silky, with trace of granulation	.12, .29*, .11	As received from the manufacturers.
5527	49	.505	.20	71,000	124,550	16.3	37.1	do	.10, .17, .22*	Do.
5528	49 A	.505	.20	71,000	124,350	14.7	37.1	Silky, interspersed with fine granulation	.09, .11, .24*	Rolled into barrel and cooled in air.
5529	49 C	.505	.20	67,000	118,100	16.0	34.0	Fine granular, silky center	.23*, .15, .10	Rolled and annealed in charcoal.
5523	49 P	.505	.20	66,000	120,000	14.3	37.1	Silky, trace of granulation	.26*, .09, .08	
5470	50	.564	.25	46,000	103,720	18.0	39.2	Silky	.11, .29*, .14	

RIFLE-BARREL STEEL, SUBJECTED TO SPECIAL TREATMENT AFTER ROLLING.

No. 5484.

Marks, 49.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000733	.000400	.....	.....	
7,500	30,000	.001033	.000300	.....	.....	
10,000	40,000	.001400	.000367	.....	.....	
12,500	50,000	.001733	.000333	0.	.....	
15,000	60,000	.002100	.000367	.....	.....	
16,250	65,000	.002267	.000167	.....	.....	
16,750	67,000	.002333	.000066	.....	.....	Elastic limit.
17,000	68,000	.002533	.000200	.....	.....	
17,250	69,000	.004700	.002167	.....	.....	
17,500	70,000	.006867	.002167	.....	.....	
17,750	71,000	.007233	.000366	.....	.....	
18,000	72,000	.007900	.000667	.....	.....	
18,250	73,000	.008367	.000467	.....	.....	
18,500	74,000	.009200	.000833	.....	.....	
19,000	76,000	.0100	.0008	.....	.....	
20,000	80,000	.0133	.0033	.....	.....	
21,000	84,000	.0167	.0034	.....	.....	
22,000	88,000	.0200	.0033	.....	.....	
23,000	92,000	.0233	.0033	.....	.....	
24,000	96,000	.0267	.0034	.....	.....	
25,000	100,000	.0300	.0033	.....	.....	
26,000	104,000	.0367	.0067	.....	.....	
27,000	108,000	.0400	.0033	.....	.....	
28,000	112,000	.0500	.0100	.....	.....	
29,000	116,000	.0633	.0133	.....	.....	
30,000	120,000	.0867	.0234	.....	.....	
30,140	120,560	.1067	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	120,560
Elastic limit per square inch of original section	do	67,000
Elongation per inch after rupture	inch	.1667
Elongation per inch under strain at elastic limit	do	.002333
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		″.95 from neck
Character of broken surface		fine silky; cup-shaped ends
Elongation of inch sections		″.29*, ″.13, ″.08

No. 5485.

Marks, 49.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000733	.000400	.....	.....	
6.000	30,000	.001067	.000334	0.	.....	
8,000	40,000	.001400	.000333	.....	.....	
10,000	50,000	.001767	.000367	0.	.....	
12,000	60,000	.002100	.000333	.....	.....	
13,000	65,000	.002300	.000200	.....	.....	
14,000	70,000	.002500	.000200	.....	.....	Elastic limit.
14,200	71,000	.002567	.000067	.....	.....	
						Load fell.
13,400	67,000	.003467	.000900	.....	.....	
13,600	68,000	.006667	.003200	.....	.....	
13,800	69,000	.009667	.003000	.....	.....	
14,000	70,000	.0100	.000333	.....	.....	
14,400	72,000	.0133	.0033	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0367	.0067	.....	.....	
20,000	100,000	.0433	.0066	.....	.....	
20,800	104,000	.0500	.0067	.....	.....	
21,600	108,000	.0633	.0133	.....	.....	
22,400	112,000	.0867	.0234	.....	.....	
22,660	113,300	.1167	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	113,300
Elastic limit per square inch of original section	do	70,000
Elongation per inch after rupture	inch	.1967
Elongation per inch under strain at elastic limit	do	.002500
Reduction in diameter at point of rupture	do	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		1″.3 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.27*, ″.21, ″.11

ROLLED, REHEATED IN GAS FURNACE, AND ANNEALED IN CHARCOAL.

No. 5486.

Marks, 490 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000333	.000200	----------	----------	
4,000	20,000	.000700	.000367	----------	----------	
6,000	30,000	.001067	.000367	----------	----------	
8,000	40,000	.001433	.000366	----------	----------	
10,000	50,000	.001800	.000367	.000033	.000033	
11,800	59,000	.002133	.000333	----------	----------	Elastic limit.
12,000	60,000	.002233	.000100	----------	----------	
		.007167	.004934	----------	----------	
12,200	61,000	.007867	.000700	----------	----------	
12,400	62,000	.008433	.000566	----------	----------	
12,600	63,000	.009000	.000567	----------	----------	
12,800	64,000	.009633	.000633	----------	----------	
13,600	68,000	.0133	.003667	----------	----------	
14,400	72,000	.0167	.0034	----------	----------	
15,200	76,000	.0200	.0033	----------	----------	
16,000	80,000	.0233	.0033	----------	----------	
16,800	84,000	.0267	.0034	----------	----------	
17,600	88,000	.0300	.0033	----------	----------	
18,400	92,000	.0367	.0067	----------	----------	
19,200	96,000	.0433	.0066	----------	----------	
20,000	100,000	.0500	.0067	----------	----------	
20,800	104,000	.0600	.0100	----------	----------	
21,600	108,000	.0800	.0200	----------	----------	
21,880	109,400	.1100	.0300	---- -------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	109,400
Elastic limit per square inch of original section	do...	59,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″.26 from neck
Character of broken surface		granular, 60 per cent; silky eccentric spot, 40 per cent
Elongation of inch sections		″.17, ″.23*, ″.18

No. 5487.

Marks, 490 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000300	.000167	----------	----------	
4,000	20,000	.000667	.000367	----------	----------	
6,000	30,000	.001033	.000366	----------	----------	
8,000	40,000	.001367	.000334	----------	----------	
10,000	50,000	.001733	.000366	0.	----------	
12,000	60,000	.002067	.000334	----------	----------	
13,000	65,000	.002267	.000200	----------	----------	Elastic limit. Load fell.
12,800	64,000	.005667	.003400	----------	----------	
13,000	65,000	.007200	.001533	----------	----------	
13,200	66,000	.008667	.001467	----------	----------	
14,400	72,000	.0133	.004633	----------	----------	
15,200	76,000	.0167	.0034	----------	----------	
16,000	80,000	.0200	.0033	----------	----------	
16,800	84,000	.0233	.0033	----------	----------	
17,600	88,000	.0267	.0034	----------	----------	
18,400	92,000	.0300	.0033	----------	----------	
19,200	96,000	.0367	.0067	----------	----------	
20,000	100,000	.0433	.0066	----------	----------	
20,800	104,000	.0500	.0067	----------	----------	
21,600	108,000	.0600	.0100	----------	----------	
22,400	112,000	.0767	.0167	----------	----------	
22,900	114,500	.1333	.0566	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	114,500
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″.6 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.13, ″.29*, ″.10

ROLLED, REHEATED IN GAS FURNACE, AND ANNEALED IN LIME.

No. 5488.

Marks, 491 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,800	69,000	.002333	.000300	.....	.....	Elastic limit.
14,000	70,000	.002500	.000167	.....	.....	
						Load fell.
13,200	66,000	.004000	.001500	.....	.....	
13,400	67,000	.006833	.002833	.....	.....	
13,600	68,000	.008667	.001834	.....	.....	
14,000	70,000	.0100	.001333	.....	.....	
15,200	76,000	.0133	.0033	.....	.....	
16,000	80,000	.0200	.0067	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0400	.0067	.....	.....	
20,800	104,000	.0467	.0067	.....	.....	
21,600	108,000	.0567	.0100	.....	.....	
22,400	112,000	.0700	.0133	.....	.....	
23,120	115,600	.1300	.0600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,600
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		1″.16 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.24*, ″.17, ″.09

No. 5489.

Marks, 491 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000300	.000167	----------	----------	
4,000	20,000	.000667	.000367	----------	----------	
6,000	30,000	.001000	.000333	----------	----------	
8,000	40,000	.001367	.000367	----------	----------	
10,000	50,000	.001733	.000366	0.	----------	
12,000	60,000	.002067	.000334	----------	----------	
13,000	65,000	.002233	.000166	----------	----------	
14,000	70,000	.002400	.000167	0.	----------	
15,000	75,000	.002600	.000200	----------	----------	Elastic limit. Load fell.
14,400	72,000	.006333	.003733	----------	----------	
14,600	73,000	.009000	.002667	----------	----------	
15,200	76,000	.0133	.0043	----------	----------	
16,000	80,000	.0167	.0034	----------	----------	
16,800	84,000	.0200	.0033	----------	----------	
17,600	88,000	.0233	.0033	----------	----------	
18,400	92,000	.0267	.0034	----------	----------	
19,200	96,000	.0300	.0033	----------	----------	
20,000	100,000	.0367	.0067	----------	----------	
20,800	104,000	.0433	.0066	----------	----------	
21,600	108,000	.0500	.0067	----------	----------	
22,400	112,000	.0600	.0100	----------	----------	
23,200	116,000	.0833	.0233	----------	----------	
23,620	118,100	.1267	.0434	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,100
Elastic limit per square inch of original section	do...	75,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002600
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.04 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.10, ″.14, ″.30*

ROLLED, REHEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5490.

Marks, 492 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	.....	.....	
12,000	60,000	.002033	.000366	0.	.....	
12,200	61,000	.002100	.000067	.....	.....	Elastic limit.
12,400	62,000	.002300	.000200	.....	.....	
12,600	63,000	.002533	.000233	.....	.....	
12,800	64,000	.003467	.000934	.....	.....	
13,000	65,000	.004500	.001033	.....	.....	
13,200	66,000	.005367	.000867	.....	.....	
13,400	67,000	.005933	.000566	.....	.....	
13,600	68,000	.006300	.000367	.....	.....	
13,800	69,000	.006933	.000633	.....	.....	
14,000	70,000	.007700	.000767	.....	.....	
15,200	76,000	.0133	.0056	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0167+	.0000+	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0500	.0067	.....	.....	
24,000	120,000	.0633	.0133	.....	.....	
24,800	124,000	.0967 .1133	.0334 .0166	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	124,000
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.7 from neck
Character of broken surface		fine granular, radiating from the center
Elongation of inch sections		″.15*, ″.10, ″.08

No. 5491.

Marks, 492 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	.....	
2,000	10,000	.000300	.000133	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,000	65,000	.002233	.000200	.....	.....	Elastic limit.
13,200	66,000	.002433	.000200	.....	.....	
13,400	67,000	.003567	.001134	.....	.....	
13,600	68,000	.004833	.001266	.....	.....	
13,800	69,000	.006000	.001167	.....	.....	
14,000	70,000	.006833	.000833	.....	.....	
14,200	71,000	.007433	.000600	.....	.....	
14,400	72,000	.007867	.000434	.....	.....	
14,600	73,000	.008500	.000633	.....	.....	
14,800	74,000	.009133	.000633	.....	.....	
15,200	76,000	.0100	.000867	.....	.....	
16,000	80,000	.0133	.0033	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0367	.0034	.....	.....	
22,400	112,000	.0433	.0066	.....	.....	
23,200	116,000	.0533	.0100	.....	.....	
24,000	120,000	.0667	.0134	.....	.....	
24,650	123,250	.1000	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,250
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture.	inch..	.1067
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.5 from neck
Character of broken surface		fine granular, radiating from an eccentric spot
Elongation of inch sections		″.16*, ″.09, ″.07

ROLLED, REHEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5492.

Marks, 493 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.001000	.000367	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,400	67,000	.002300	.000267	.....	.....	Elastic limit.
13,600	68,000	.002667	.000367	.....	.....	
13,800	69,000	.003633	.000966	.....	.....	
14,000	70,000	.004867	.001234	.....	.....	
14,200	71,000	.005600	.000733	.....	.....	
14,400	72,000	.006333	.000733	.....	.....	
15,200	76,000	.0100	.003667	.....	.....	
16,000	80,000	.0133	.0033	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
18,400	92,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0333	.0033	.....	.....	
22,400	112,000	.0367	.0034	.....	.....	
23,200	116,000	.0433	.0066	.....	.....	
24,000	120,000	.0500	.0067	.....	.....	
24,800	124,000	.0633	.0133	.....	.....	
25,460	127,300	.0900	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	127,300
Elastic limit per square inch of original section	do...	67,000
Elongation per inch after rupture	inch..	.1067
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20.5
Position of rupture		″.55 from neck
Character of broken surface		fine granular, radiating from a point near the center
Elongation of inch sections		″.07, ″.08, ″.17*

No. 5493.

Marks, 493 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001033	.000333	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002100	.000367	.....	.....	
13,000	65,000	.002300	.000200	.....	.....	Elastic limit.
13,200	66,000	.002433	.000133	.....	.....	
13,400	67,000	.002867	.000434	.....	.....	
13,600	68,000	.004067	.001200	.....	.....	
13,800	69,000	.004667	.000600	.....	.....	
14,000	70,000	.005367	.000700	.....	.....	
14,200	71,000	.005667	.000300	.....	.....	
14,400	72,000	.006033	.000366	.....	.....	
14,600	73,000	.006533	.000500	.....	.....	
14,800	74,000	.007300	.000767	.....	.....	
15,000	75,000	.007833	.000533	.....	.....	
15,200	76,000	.008467	.000634	.....	.....	
16,000	80,000	.0133	.004833	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
19,200	96,000	.0233	.0033	.....	.....	
20,000	100,000	.0267	.0034	.....	.....	
20,800	104,000	.0300	.0033	.....	.....	
21,600	108,000	.0333	.0033	.....	.....	
22,400	112,000	.0400	.0067	.....	.....	
23,200	116,000	.0467	.0067	.....	.....	
24,000	120,000	.0567	.0100	.....	.....	
24,800	124,000	.0700	.0133	.....	.....	
25,180	125,900	.0967	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	125,900
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.045
Reduction in area after rupture, per cent of original section		16.9
Position of rupture		″.70 from neck
Character of broken surface		fine granular, radiating from a dull silky center
Elongation of inch sections		″.17*, ″.09, ″.07

ROLLED, REHEATED IN GAS FURNACE, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5494.

Marks, 494 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001667	.000334	0.	.....	
12,000	60,000	.002000	.000333	0.	.....	
12,800	64,000	.002133	.000133	.....	.....	Elastic limit.
13,000	65,000	.002233	.000100	.....	.....	
						Load fell.
12,600	63,000	.003133	.000900	.....	.....	
12,800	64,000	.006167	.003034	.....	.....	
13,000	65,000	.008967	.002800	.....	.....	
13,200	66,000	.009667	.000700	.....	.....	
14,000	70,000	.0133	.003633	.....	.....	
15,200	76,000	.0200	.0067	.....	.....	
16,000	80,000	.0233	.0033	.....	.....	
16,800	84,000	.0267	.0034	.....	.....	
17,600	88,000	.0300	.0033	.....	.....	
18,400	92,000	.0333	.0033	.....	.....	
19,200	96,000	.0400	.0067	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0667	.0100	.....	.....	
22,400	112,000	.1000	.0333	.....	.....	
22,450	112,250	.1200	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	112,250
Elastic limit per square inch of original section	do	64,000
Elongation per inch after rupture	inch	.1767
Elongation per inch under strain at elastic limit	do	.002133
Reduction in diameter at point of rupture	do	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.6 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.12, ″.27*, ″.14

No. 5495.

Marks, 494 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	.....	
2,000	10,000	.000333	.000166	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001067	.000367	.....	.....	
8,000	40,000	.001400	.000333	.....	.....	
10,000	50,000	.001767	.000367	0.	.....	
11,000	55,000	.002000	.000233	.....	.....	
12,000	60,000	.002133	.000133	.....	.....	
13,000	65,000	.002333	.000200	.....	.....	Elastic limit. Load fell.
12,800	64,000	.005133	.002800	.....	.....	
13,000	65,000	.006800	.001667	.....	.....	
13,200	66,000	.009000	.002200	.....	.....	
14,400	72,000	.0133	.0043	.....	.....	
15,200	76,000	.0200	.0067	.....	.....	
16,000	80,000	.0233	.0033	.....	.....	
16,800	84,000	.0267	.0034	.....	.....	
17,600	88,000	.0300	.0033	.....	.....	
18,400	92,000	.0333	.0033	.....	.....	
19,200	96,000	.0367	.0034	.....	.....	
20,000	100,000	.0467	.0100	.....	.....	
20,800	104,000	.0533	.0066	.....	.....	
21,600	108,000	.0667	.0134	.....	.....	
22,400	112,000	.1000	.0333	.....	.....	
22,570	112,850	.1167	.0167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,850
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1700
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.68 from neck
Character of broken surface		silky, with a trace of granulation
Elongation of inch sections		″.12, ″.27, ″.12

ROLLED, REHEATED IN GAS FURNACE, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5496.

Marks, 495 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002100	.000367	.....	.....	
13,200	66,000	.002267	.000167	.....	.....	Elastic limit.
13,400	67,000	.002467	.000200	.....	.....	
						Load fell.
12,800	64,000	.004100	.001633	.....	.....	
13,000	65,000	.007733	.003633	.....	.....	
13,200	66,000	.008300	.000567	.....	.....	
14,400	72,000	.0133	.0050	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0333	.0033	.....	.....	
20,000	100,000	.0400	.0067	.....	.....	
20,800	104,000	.0433	.0033	.....	.....	
21,600	108,000	.0500	.0067	.....	.....	
22,400	112,000	.0667	.0167	.....	.....	
23,200	116,000	.0900	.0233	.....	.....	
23,280	116,400	.1067	.0167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	116,400
Elastic limit per square inch of original section	do...	66,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		″.95 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.09, ″.12, ″.24*

No. 5497.

Marks, 495 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50.000	.001667	.000334	0.	.....	
12,000	60,000	.002033	.000366	.....	.....	
13,000	65,000	.002200	.000167	.....	.....	
13,800	69,000	.002367	.000167	.....	.....	Elastic limit, Load fell.
13,600	68,000	.002833	.000466	.....	.....	
13,800	69,000	.003267	.000434	.....	.....	
14,000	70,000	.004300	.001033	.....	.....	
		.009833	.005533	.....	.....	
14,400	72,000	.0133	.003467	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0333	.0066	.....	.....	
20,000	100,000	.0367	.0034	.....	.....	
20,800	104,000	.0433	.0066	.....	.....	
21,600	108,000	.0533	.0100	.....	.....	
22,400	112,000	.0667	.0134	.....	.....	
22,420	112,100	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	112,100
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1167
Elongation per inch under strain at elastic limit	do...	.002367
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		″.25 from neck.
Character of broken surface		exceedingly fine granular, radiating from a point near the center; cup-shaped ends.
Elongation of inch sections		″.04, ″.05, ″.26*

ROLLED, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5498.

Marks, 496 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	.....	
2,000	10,000	.000333	.000166	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001333	.000333	.....	.....	
10,000	50,000	.001700	.000367	0.	.....	
11,000	55,000	.001867	.000167	.....	.....	
12,000	60,000	.002033	.000166	0.	.....	
13,060	65,000	.002267	.000234	.....	.....	Elastic limit.
13,200	66,000	.004000	.001733	.....	.....	
13,400	67,000	.006100	.002100	.....	.....	
13,600	68,000	.008167	.002167	.....	.....	
14,400	72,000	.0133	.005133	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0400	.0067	.....	.....	
21,600	108,000	.0467	.0067	.....	.....	
22,400	112,000	.0533	.0066	.....	.....	
23,200	116,000	.0667	.0134	.....	.....	
23,960	119,800	.1133	.0466	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,800
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1500
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		″.9 from neck
Character of broken surface		silky and fine granulation interspersed
Elongation of inch sections		″.22*, ″.13, ″.10

No. 5499.

Marks, 496 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
13,000	65,000	.002233	.000166	.....	.....	
13,600	68,000	.002367	.000134	.....	.....	Elastic limit.
13,800	69,000	.003000	.000633	.....	.....	
						Load fell.
12,800	64,000	.003100	.000100	.....	.....	
13,000	65,000	.003367	.000267	.....	.....	
13,200	66,000	.004100	.000733	.....	.....	
13,400	67,000	.005933	.001833	.....	.....	
13,600	68,000	.009167	.003234	.....	.....	
14,400	72,000	.0133	.004133	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0367	.0067	.....	.....	
20,800	104,000	.0400	.0033	.....	.....	
21,600	108,000	.0467	.0067	.....	.....	
22,400	112,000	.0567	.0100	.....	.....	
23,200	116,000	.0700	.0133	.....	.....	
23,810	119,050	.1133	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	119,050
Elastic limit per square inch of original section	do	68,000
Elongation per inch after rupture	inch	.1767
Elongation per inch under strain at elastic limit	do	.002367
Reduction in diameter at point of rupture	do	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		1″.4 from neck
Character of broken surface		silky and fine granulation interspersed
Elongation of inch sections		″.13, ″.24*, ″.16

ROLLED, ANNEALED IN CHARCOAL, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5500.

Marks, 497 B.
Diameter, ″.505.
Sectional area, .20 square inc'
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	----------	
2,000	10,000	.000333	.000166	----------	----------	
4,000	20,000	.000667	.000334	----------	----------	
6,000	30,000	.001033	.000366	----------	----------	
8,000	40,000	.001367	.000334	----------	----------	
10,000	50,000	.001700	.000333	0.	----------	
12,000	60,000	.002067	.000367	.000033	.000033	
12,600	63,000	.002233	.000166	----------	----------	Elastic limit.
12,800	64,000	.002500	.000267	----------	----------	
						Load fell.
12,400	62,000	.002833	.000333	----------	----------	
12,600	63,000	.003467	.000634	----------	----------	
12,800	64,000	.005033	.001566	----------	----------	
13,000	65,000	.005467	.000434	----------	----------	
13,200	66,000	.006300	.000833	----------	----------	
13,400	67,000	.006600	.000300	----------	----------	
13,600	68,000	.007267	.000667	----------	----------	
13,800	69,000	.007933	.000666	----------	----------	
14,000	70,000	.008600	.000667	----------	----------	
14,400	72,000	.0100	.0014	----------	----------	
15,200	76,000	.0133	.0033	----------	----------	
16,000	80,000	.0167	.0034	----------	----------	
16,800	84,000	.0200	.0033	----------	----------	
17,600	88,000	.0233	.0033	----------	----------	
18,400	92,000	.0267	.0034	----------	----------	
19,200	96,000	.0300	.0033	----------	----------	
20,000	100,000	.0333	.0033	----------	----------	
20,800	104,000	.0367	.0034	----------	----------	
21,600	108,000	.0433	.0066	----------	----------	
22,400	112,000	.0500	.0067	----------	----------	
23,200	116,000	.0633	.0133	----------	----------	
24,000	120,000	.0967	.0334	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,000
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.1333
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		″.9 from neck
Character of broken surface		fine granular dull silky eccentric spot
Elongation of inch sections		″.08, ″.12, ″.20*

No. 5501.

Marks, 497 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1.000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
13,000	65,000	.002267	.000200	.....	.....	
13,800	69,000	.002433	.000166	.....	.....	Elastic limit.
14,000	70,000	.002833	.000400	.....	.....	
		.003933	.001100	.....	.....	
14,200	71,000	.005500	.001567	.....	.....	
14,400	72,000	.006733	.001233	.....	.....	
15,200	76,000	.0100	.003267	.....	.....	
16,000	80,000	.0133	.0033	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0400	.0067	.....	.....	
22,400	112,000	.0433	.0033	.....	.....	
23,200	116,000	.0567	.0134	.....	.....	
24,000	120,000	.0733	.0166	.....	.....	
24,620	123,100	.1133	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,100
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002433
Reduction in diameter at point of rupture	do...	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1″ from neck
Character of broken surface		silky, with trace of granulation
Elongation of inch sections		″.26*, ″.14, ″.10

ROLLED, ANNEALED IN AIR, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN CHARCOAL.

No. 5502.

Marks, 498 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	----------	
2,000	10,000	.000333	.000166	----------	----------	
4,000	20,000	.000700	.000367	----------	----------	
6,000	30,000	.001033	.000333	----------	----------	
8,000	40,000	.001367	.000334	----------	----------	
10,000	50,000	.001733	.000366	000033	.000033	
11,000	55,000	.001933	.000200	----------	----------	
11,200	56,000	.002000	.000067	----------	----------	Elastic limit.
11,400	57,000	.003267	.001267	----------	----------	
11,600	58,000	.003733	.000466	----------	----------	
11,800	59,000	.004000	.000267	----------	----------	
12,000	60,000	.004667	.000667	----------	----------	
12,200	61,000	.005367	.000700	----------	----------	
12,400	62,000	.006300	.000933	----------	----------	
12,600	63,000	.007000	.000700	----------	----------	
12,800	64,000	.007500	.000500	----------	----------	
13,600	68,000	.0100	.0025	----------	----------	
14,400	72,000	.0133	.0033	----------	----------	
15,200	76,000	.0167	.0034	----------	----------	
16,000	80,000	.0200	.0033	----------	----------	
16,800	84,000	.0233	.0033	----------	----------	
17,600	88,000	.0267	.0034	----------	----------	
18,400	92,000	.0300	.0033	----------	----------	
19,200	96,000	.0333	.0033	----------	----------	
20,000	100,000	.0400	.0067	----------	----------	
20,800	104,000	.0467	.0067	----------	----------	
21,600	108,000	.0567	.0100	----------	----------	
22,400	112,000	.0733	.0166	----------	----------	
22,820	114,100	.1100	.0367	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	114,000
Elastic limit per square inch of original section	do	56,000
Elongation per inch after rupture	inch	.1533
Elongation per inch under strain at elastic limit	do	.002000
Reduction in diameter at point of rupture	do	.075
Reduction in area after rupture, per cent of original section		27.4
Position of rupture		1.″1 from neck
Character of broken surface		granular, irregular surface; dull spot at the circumference
Elongation of inch sections		″.21*, ″.14, ″.11

No. 5503.

Marks, 498 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000300	.000167	----------	----------	
4,000	20,000	.000667	.000367	----------	----------	
6,000	30,000	.001033	.000366	----------	----------	
8,000	40,000	.001367	.000334	----------	----------	
10,000	50,000	.001733	.000366	.000033	.000033	
11,000	55,000	.001900	.000167	----------	----------	
11,800	59,000	.002067	.000167	----------	----------	
12,000	60,000	.002133	.000066	.000067	.000034	Elastic limit.
12,200	61,000	.002367	.000234	----------	----------	
		.002967	.000600	----------	----------	
12,400	62,000	.004967	.002000	----------	----------	
12,600	63,000	.005500	.000533	----------	----------	
12,800	64,000	.006233	.000733	----------	----------	
13,000	65,000	.006700	.000467	----------	----------	
13,200	66,000	.007167	.000467	----------	----------	
13,400	67,000	.007800	.000633	----------	----------	
13,600	68,000	.008633	.000833	----------	----------	
14,400	72,000	.0133	.004667	----------	----------	
15,200	76,000	.0167	.0034	----------	----------	
16,800	84,000	.0200	.0033	----------	----------	
17,600	88,000	.0233	.0033	----------	----------	
18,400	92,000	.0267	.0034	----------	----------	
19,200	96,000	.0300	.0033	----------	----------	
20,000	100,000	.0333	.0033	----------	----------	
20,800	104,000	.0400	.0067	----------	----------	
21,600	108,000	.0467	.0067	----------	----------	
22,400	112,000	.0567	.0100	----------	----------	
23,200	116,000	.0733	.0166	----------	----------	
23,640	118,200	.1133	.0400	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,200
Elastic limit per square inch of original section	do...	60,000
Elongation per inch after rupture..	inch..	.1400
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do..	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		″.9 from neck
Character of broken surface		fine granular, dull center
Elongation of inch sections		″.08, ″.11, ″.23*

ROLLED, ANNEALED IN AIR, HEATED IN OPEN COKE FIRE TO LIGHT CHERRY COLOR, AND ANNEALED IN LIME.

No. 5504.

Marks, 499 B.
Diameter ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000333	.000200	----------	----------	
4,000	20,000	.000667	.000334	----------	----------	
6,000	30,000	.001000	.000333	----------	----------	
8,000	40,000	.001367	.000367	----------	----------	
10,000	50,000	.001700	.000333	0.	----------	
11,000	55,000	.001867	.000167	----------	----------	
12,000	60,000	.002033	.000166	----------	----------	
12,600	63,000	.002133	.000100	----------	----------	Elastic limit.
12,800	64,000	.002367	.000234	----------	----------	
13,000	65,000	.003367	.001000	----------	----------	
13,200	66,000	.006767	.003400	----------	----------	
13,400	67,000	.007267	.000500	----------	----------	
13,600	68,000	.008100	.000833	----------	----------	
14,400	72,000	.0133	.0052	----------	----------	
15,200	76,000	.0167	.0034	----------	----------	
16,800	84,000	.0200	.0033	----------	----------	
17,600	88,000	.0233	.0033	----------	----------	
18,400	92,000	.0267	.0034	----------	----------	
19,200	96,000	.0333	.0066	----------	----------	
20,000	100,000	.0367	.0034	----------	----------	
20,800	104,000	.0433	.0066	----------	----------	
21,600	108,000	.0533	.0100	----------	----------	
22,400	112,000	.0667	.0134	----------	----------	
23,100	115,500	.1033	.0366	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,500
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.1367
Elongation per inch under strain at elastic limit	do...	.002133
Reduction in diameter at point of rupture	do...	.085
Reduction in area after rupture, per cent of original section		30.7
Position of rupture		″.7 from neck
Character of broken surface		fine granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		″.23*, ″.10, ″.08

No. 5505.

Marks, 499 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000167	.000167	0.	----------	
2,000	10,000	.000367	.000200	----------	----------	
4,000	20,000	.000700	.000333	----------	----------	
6,000	30,000	.001033	.000333	----------	----------	
8,000	40,000	.001400	.000367	----------	----------	
10,000	50,000	.001733	.000333	0.	----------	
11,000	55,000	.001900	.000167	----------	----------	
12,000	60,000	.002100	.000200	----------	----------	
14,000	70,000	.002467	.000367	----------	----------	
14,200	71,000	.002533	.000066	----------	----------	Elastic limit. Load fell.
13,600	68,000	.003333	.000800	----------	----------	
13,800	69,000	.004467	.001134	----------	----------	
14,000	70,000	.006167	.001700	----------	----------	
14,200	71,000	.008000	.001833	----------	----------	
14,400	72,000	.011000	.003000	----------	----------	
15,200	76,000	.0133	.0023	----------	----------	
16,000	80,000	.0167	.0034	----------	----------	
16,800	84,000	.0200	.0033	----------	----------	
17,600	88,000	.0233	.0033	----------	----------	
18,400	92,000	.0267	.0034	----------	----------	
19,200	96,000	.0333	.0066	----------	----------	
20,000	100,000	.0400	.0067	----------	----------	
20,800	104,000	.0467	.0067	----------	----------	
21,600	108,000	.0567	.0100	----------	----------	
22,400	112,000	.0700	.0133	----------	----------	
23,050	115,250	.1167	.0467	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	115,250
Elastic limit per square inch of original section	do	71,000
Elongation per inch after rupture	inch	.1733
Elongation per inch under strain at elastic limit	do	.002533
Reduction in diameter at point of rupture	do	.105
Reduction in area after rupture, per cent of original section		37.1
Position of rupture		1.″2 from neck
Character of broken surface		fine, silky; cup-shaped ends
Elongation of inch sections		″.10, ″.17, ″.25*

REGULAR STOCK, RECENT MANUFACTURE.

No. 5510.

Marks, 49.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	----------	
2,500	10,000	.000367	.000234	----------	----------	
5,000	20,000	.000733	.000366	----------	----------	
7,500	30,000	.001067	.000334	----------	----------	
10,000	40,000	.001400	.000333	0.	----------	
12,500	50,000	.001733	.000333	----------	----------	
15,000	60,000	.002100	.000367	.000033	.000033	
16,000	64,000	.002233	.000133	----------	----------	Elastic limit.
16,250	65,000	.003367	.001134	----------	----------	
						Load fell.
15,000	60,000	.006167	.002800	----------	----------	
15,250	61,000	.008667	.002500	----------	----------	
15,500	62,000	.009333	.000666	----------	----------	
16,000	64,000	.0100	.000667	----------	----------	
16,500	66,000	.0133	.0033	----------	----------	
17,000	68,000	.0167	.0034	----------	----------	
18,000	72,000	.0200	.0033	----------	----------	
19,000	76,000	.0233	.0033	----------	----------	
20,000	80,000	.0267	.0034	----------	----------	
20,500	82,000	.0300	.0033	----------	----------	
21,500	86,000	.0333	.0033	----------	----------	
22,000	88,000	.0367	.0034	----------	----------	
22,500	90,000	.0400	.0033	----------	----------	
23,000	92,000	.0433	.0033	----------	----------	
23,500	94,000	.0500	.0067	----------	----------	
24,000	96,000	.0533	.0033	----------	----------	
24,500	98,000	.0600	.0067	----------	----------	
25,000	100,000	.0667	.0067	----------	----------	
25,500	102,000	.0800	.0133	----------	----------	
26,000	104,000	.1067	.0267	----------	----------	
26,180	104,720	.1333	.0266	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	104,720
Elastic limit per square inch of original section	do	64,000
Elongation per inch after rupture	inch	.2233
Elongation per inch under strain at elastic limit	do	.002233
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.15, ″.38*, ″.14

SAME AS SPECIMEN No. 5510.

No. 5511.

Marks, 49.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002100	.000367	.000033	.000033	
12,200	61,000	.002133	.000033	.....	.....	
12,400	62,000	.002167	.000034	.....	.....	
12,600	63,000	.002233	.000066	.....	.....	Elastic limit.
12,800	64,000	.....	.....	.....	.....	Momentarily reached, then load fell.
12,200	61,000	.005167	.002934	.....	.....	
12,400	62,000	.008333	.003166	.....	.....	
12,800	64,000	.0133	.004967	.....	.....	
13,600	68,000	.0167	.0034	.....	.....	
14,400	72,000	.0200	.0033	.....	.....	
15,200	76,000	.0233	.0033	.....	.....	
16,000	80,000	.0267	.0034	.....	.....	
16,800	84,000	.0300	.0033	.....	.....	
17,600	88,000	.0367	.0067	.....	.....	
18,400	92,000	.0433	.0066	.....	.....	
19,200	96,000	.0533	.0100	.....	.....	
20,000	100,000	.0700	.0167	.....	.....	
20,800	104,000	.0967	.0267	.....	.....	
20,980	104,900	.1400	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	104,900
Elastic limit per square inch of original section	do	63,000
Elongation per inch after rupture	inch	.2100
Elongation per inch under strain at elastic limit	do	.002233
Reduction in diameter at point of rupture	do	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.14, ″.36*, ″.13

STOCK HEATED AND ROLLED TO BARREL, AND ANNEALED (COOLED) IN AIR.

No. 5512.

Marks, 49 A.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000333	.000200	----------	----------	
4,000	20,000	.000667	.000334	----------	----------	
6,000	30,000	.001000	.000333	----------	----------	
8,000	40,000	.001333	.000333	----------	----------	
10,000	50,000	.001700	.000367	0.	----------	
11,000	55,000	.001867	.000167	----------	----------	
12,000	60,000	.002033	.000166	0.	----------	
12,800	64,000	.002167	.000134	----------	----------	
13,000	65,000	.002200	.000033	----------	----------	
13,200	66,000	.002267	.000067	----------	----------	
13,400	67,000	.002300	.000033	----------	----------	
13,600	68,000	.002333	.000033	----------	----------	
13,800	69,000	.002367	.000034	----------	----------	
14,000	70,000	.002400	.000033	----------	----------	
14,200	71,000	.002433	.000033	----------	----------	
14,400	72,000	.002467	.000034	----------	----------	
14,600	73,000	.002500	.000033	----------	----------	
14,800	74,000	.002533	.000033	----------	----------	
15,000	75,000	.002600	.000067	----------	----------	
16,000	80,000	.002767	.000167	----------	----------	Elastic limit. Load fell.
15,000	75,000	.010000	.007233	----------	----------	
15,200	76,000	.0167	.0067	----------	----------	
16,000	80,000	.0200	.0033	----------	----------	
16,800	84,000	.0233	.0033	----------	----------	
17,600	88,000	.0267	.0034	----------	----------	
18,400	92,000	.0300	.0033	----------	----------	
19,200	96,000	.0333	.0033	----------	----------	
20,000	100,000	.0400	.0067	----------	----------	
20,800	104,000	.0467	.0067	----------	----------	
21,600	108,000	.0567	.0100	----------	----------	
22,400	112,000	.0700	.0133	----------	----------	
23,200	116,000	.1067	.0367	----------	----------	
23,240	116,200	.1400	.0333	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	116,200
Elastic limit per square inch of original section	do...	80,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.002767
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		″.95 from neck
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.11, ″.12, ″.33*

DUPLICATE OF NO. 5512.

No. 5513.

Marks, 49 A.
Diameter, ″.505.
Sectional area, .20 square inch
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002067	.000367	.....	.....	
14,000	70,000	.002433	.000366	.....	.....	
14,200	71,000	.002467	.000034	.....	.....	
14,400	72,000	.002533	.000066	.....	.....	
14,600	73,000	.002567	.000034	.....	.....	
14,800	74,000	.002600	.000033	.....	.....	
15,000	75,000	.002633	.000033	.....	.....	
15,200	76,000	.002667	.000034	.....	.....	
15,400	77,000	.002700	.000033	.....	.....	
15,600	78,000	.002733	.000033	.....	.....	
15,800	79,000	.002767	.000034	.....	.....	
16,000	80,000	.002800	.000033	.....	.....	
16,200	81,000	.002833	.000033	.....	.....	
16,400	82,000	.002867	.000034	.....	.....	
16,600	83,000	.002900	.000033	.....	.....	Elastic limit. Load fell.
15,400	77,000	.006133	.003233	.....	.....	
15,600	78,000	.0133	.007167	.....	.....	
16,800	84,000	.0167	.0034	.....	.....	
17,600	88,000	.0200	.0033	.....	.....	
18,400	92,000	.0233	.0033	.....	.....	
19,200	96,000	.0267	.0034	.....	.....	
20,000	100,000	.0300	.0033	.....	.....	
20,800	104,000	.0333	.0033	.....	.....	
21,600	108,000	.0400	.0067	.....	.....	
22,400	112,000	.0467	.0067	.....	.....	
23,200	116,000	.0533	.0066	.....	.....	
24,000	120,000	.0667	.0134	.....	.....	
24,670	123,350	.1067	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	123,350
Elastic limit per square inch of original section	do...	83,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.002900
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Position of rupture		1″ from neck
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.11, ″.13, ″.29*

STOCK HEATED, ROLLED TO BARREL, AND ANNEALED IN LIME.

No. 5514.

Marks, 49 L.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,000	10,000	.000333	.000200	----------	----------	
4,000	20,000	.000667	.000334	----------	----------	
6,000	30,000	.001000	.000333	----------	----------	
8,000	40,000	.001367	.000367	----------	----------	
10,000	50,000	.001400	.000033	0.	----------	
12,000	60,000	.002067	.000667	----------	----------	
14,000	70,000	.002467	.000400	----------	----------	
14,800	74,000	.002600	.000133	----------	----------	Elastic limit. Load fell.
13,400	67,000	.008000	.005400	----------	----------	
13,600	68,000	.010667	.002667	----------	----------	
14,000	70,000	.0133	.002633	----------	----------	
15,200	76,000	.0167	.0034	----------	----------	
16,000	80,000	.0200	.0033	----------	----------	
16,800	84,000	.0233	.0033	----------	----------	
17,600	88,000	.0267	.0034	----------	----------	
18,400	92,000	.0333	.0066	----------	----------	
19,200	96,000	.0367	.0034	----------	----------	
20,000	100,000	.0433	.0066	----------	----------	
20,800	104,000	.0533	.0100	----------	----------	
21,600	108,000	.0633	.0100	----------	----------	
22,400	112,000	.1000	.0367	----------	----------	
22,410	112,050	.1233	.0233	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	112,050
Elastic limit per square inch of original section	do	74,000
Elongation per inch after rupture	inch	.2033
Elongation per inch under strain at elastic limit	do	.002600
Reduction in diameter at point of rupture	do	.155
Reduction in area after rupture, per cent of original section		51.9
Position of rupture		1″.67 from neck
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.12, ″.35,* ″.14

DUPLICATE OF NO. 5514.

No. 5515.

Marks, 49 L.
Diameter, ″.505.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000700	.000367	.....	.....	
6,000	30,000	.001067	.000367	.....	.....	
8,000	40,000	.001433	.000366	.....	.....	
10,000	50,000	.001767	.000334	0.	.....	
12,000	60,000	.002133	.000366	.....	.....	
14,000	70,000	.002533	.000400	.....	.....	Elastic limit. Load fell.
12,800	64,000	.006133	.003600	.....	.....	
13,000	65,000	.006667	.000534	.....	.....	
13,200	66,000	.009667	.003000	.....	.....	
14,000	70,000	.0133	.003633	.....	.....	
15,200	76,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0300	.0033	.....	.....	
19,200	96,000	.0367	.0067	.....	.....	
20,000	100,000	.0433	.0066	.....	.....	
20,800	104,000	.0500	.0067	.....	.....	
21,600	108,000	.0633	.0133	.....	.....	
22,400	112,000	.0867	.0234	.....	.....	
22,640	113,320	.1267	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	113,320
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1867
Elongation per inch under strain at elastic limit	do...	.002533
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1.″29 from neck
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.26*, ″.19, ″.11

STOCK HEATED AND ROLLED TO BARREL AND ANNEALED IN SAND.

No. 5516.

Marks, 49 S.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001000	.000333	.....	.....	
8,000	40,000	.001367	.000367	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002100	.000400	.....	.....	
14,000	70,000	.002500	.000400	.....	.....	Elastic limit. Load fell.
13,000	65,000	.006333	.003833	.....	.....	
13,200	66,000	.009333	.003000	.....	.....	
13,600	68,000	.0133	.003967	.....	.....	
14,400	72,000	.0167	.0034	.....	.....	
16,000	80,000	.0200	.0033	.....	.....	
16,800	84,000	.0233	.0033	.....	.....	
17,600	88,000	.0267	.0034	.....	.....	
18,400	92,000	.0333	.0066	.....	.....	
19,200	96,000	.0400	.0067	.....	.....	
20,000	100,000	.0467	.0067	.....	.....	
20,800	104,000	.0567	.0100	.....	.....	
21,600	108,000	.0733	.0166	.....	.....	
22,180	110,900	.1133	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	110,900
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.002500
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.6 from neck
Character of broken surface		silky; cup shaped ends
Elongation of inch sections		″.16, ″.32*, ″.11

DUPLICATE OF No. 5516.

No. 5517.

Marks, 49 S.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000333	.000200	.....	.....	
4,000	20,000	.000667	.000334	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001400	.000367	.....	.....	
10,000	50,000	.001733	.000333	0.	.....	
12,000	60,000	.002133	.000400	.....	.....	
14,000	70,000	.002500	.000367	.000067	.000067	Elastic limit.
14,000	70,000	.008767	.006267	.....	.....	Application of load after determining set.
14,400	72,000	.0100	.001233	.....	.....	
14,800	74,000	.0133	.0033	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
16,800	84,000	.0200	.0033	.....	.....	
17,600	88,000	.0233	.0033	.....	.....	
18,400	92,000	.0267	.0034	.....	.....	
19,200	96,000	.0300	.0033	.....	.....	
20,000	100,000	.0333	.0033	.....	.....	
20,800	104,000	.0367	.0034	.....	.....	
21,600	108,000	.0467	.0100	.....	.....	
22,400	112,000	.0567	.0100	.....	.....	
23,200	116,000	.0733	.0166	.....	.....	
23,630	118,150	.1133	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,150
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002500
Reduction in diameter at point of rupture	do...	.115
Reduction in area after rupture, per cent of original section		40.3
Position of rupture		at middle of stem
Character of broken surface		silky; cup-shaped ends
Elongation of inch sections		″.12, ″.30*, ″.12

REGULAR STOCK ROLLED IN BAR 1″.1 DIAMETER, FROM WHICH BARRELS WERE MADE WITHOUT HEATING.

No. 5518.

Marks, 57.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000367	.000234	.....	.....	
5,000	20,000	.000733	.000366	.....	.....	
7,500	30,000	.001100	.000367	.....	.....	
10,000	40,000	.001433	.000333	0.	.....	
12,500	50,000	.001800	.000367	.....	.....	
15,000	60,000	.002167	.000367	0.	.....	
16,250	65,000	.002300	.000133	.....	.....	
17,500	70,000	.002500	.000200	0.	.....	
17,750	71,000	.002533	.000033	.....	.....	
18,000	72,000	.002567	.000034	.....	.....	
18,250	73,000	.002600	.000033	.....	.....	
18,500	74,000	.002633	.000033	.....	.....	
18,750	75,000	.002667	.000034	.....	.....	
19,000	76,000	.002700	.000033	.....	.....	
19,250	77,000	.002767	.000067	.....	.....	Elastic limit. Load fell.
18,000	72,000	.005233	.002466	.....	.....	
18,250	73,000	.006167	.000934	.....	.....	
18,500	74,000	.008000	.001833	.....	.....	
18,750	75,000	.008533	.000533	.....	.....	
19,000	76,000	.009000	.000467	.....	.....	
19,500	78,000	.0133	.0043	.....	.....	
21,000	84,000	.0167	.0034	.....	.....	
22,000	88,000	.0200	.0033	.....	.....	
24,000	96,000	.0233	.0033	.....	.....	
25,000	100,000	.0267	.0034	.....	.....	
26,000	104,000	.0333	.0066	.....	.....	
27,000	108,000	.0367	.0034	.....	.....	
28,000	112,000	.0433	.0066	.....	.....	
29,000	116,000	.0500	.0067	.....	.....	
30,000	120,000	.0600	.0100	.....	.....	
31,000	124,000	.0833	.0233	.....	.....	
31,240	124,960	.1100	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	124,960
Elastic limit per square inch of original section	do	77,000
Elongation per inch after rupture	inch	.1833
Elongation per inch under strain at elastic limit	do	.002767
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.4 from neck
Character of broken surface		silky; cup-shaped end
Elongation of inch sections		″.10, ″.31*, ″.14

ANNEALED IN CHARCOAL AFTER ROLLING.

No. 5531.

Marks, 49 B.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	----------	
2,600	10,000	.000300	.000167	----------	----------	
4,000	20,000	.000633	.000333	----------	----------	
6,000	30,000	.001000	.000367	----------	----------	
8,000	40,000	.001333	.000333	----------	----------	
10,000	50,000	.001667	.000334	0.	----------	
12,000	60,000	.002000	.000333	----------	----------	
13,400	67,000	.002300	.060300	----------	----------	Elastic limit. Load fell.
12,400	62,000	.004000	.001700	----------	----------	
12,600	63,000	.004500	.000500	----------	----------	
12,800	64,000	.008000	.003500	----------	----------	
13,000	65,000	.0133	.0053	----------	----------	
14,000	70,000	.0167	.0034	----------	----------	
15,200	76,000	.0200	.0033	----------	----------	
15,600	78,000	.0233	.0033	----------	----------	
16,400	82,000	.0267	.0034	----------	----------	
17,200	86,000	.0300	.0033	----------	----------	
17,600	88,000	.0333	.0033	----------	----------	
18,400	92,000	.0367	.0034	----------	----------	
18,800	94,000	.0400	.0033	----------	----------	
19,200	96,000	.0433	.0033	----------	----------	
19,600	98,000	.0467	.0034	----------	----------	
20,000	100,000	.0533	.0066	----------	----------	
20,400	102,000	.0567	.0034	----------	----------	
20,800	104,000	.0633	.0066	----------	----------	
21,200	106,000	.0700	.0067	----------	----------	
21,600	108,000	.0800	.0100	----------	----------	
22,000	110,000	.1133	.0333	----------	----------	
22,010	110,050	.1267	.0134	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	110.050
Elastic limit per square inch of original section	do	67,000
Elongation per inch after rupture	inch	.1900
Elongation per inch under strain at elastic limit	do	.002300
Reduction in diameter at point of rupture	do	.095
Reduction in area after rupture, per cent of original section		34.0
Position of rupture		1″.5 from neck
Character of broken surface		silky, interspersed with fine granulation
Elongation of inch sections		″.17, ″.28*, ″.12

ANNEALED IN CHARCOAL AFTER ROLLING.

No. 5532.

Marks, 49 M.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000133	.000133	0.	.....	
2,000	10,000	.000300	.000167	.....	.....	
4,000	20,000	.000667	.000367	.....	.....	
6,000	30,000	.001033	.000366	.....	.....	
8,000	40,000	.001367	.000334	.....	.....	
10,000	50,000	.001700	.000333	0.	.....	
12,000	60,000	.002033	.000333	.....	.....	
13,800	69,000	.002333	.000300	.....	.....	Elastic limit. Load fell.
13,200	66,000	.003333	.001000	.....	.....	
13,400	67,000	.003500	.000167	.....	.....	
13,600	68,000	.004467	.000967	.....	.....	
13,800	69,000	.006233	.001766	.....	.....	
14,000	70,000	.006867	.000634	.....	.....	
14,200	71,000	.007867	.001000	.....	.....	
14,400	72,000	.008500	.000633	.....	.....	
14,600	73,000	.008867	.000367	.....	.....	
14,800	74,000	.009333	.000466	.....	.....	
15,200	76,000	.0133	.003967	.....	.....	
16,000	80,000	.0167	.0034	.....	.....	
17,200	86,000	.0200	.0033	.....	.....	
18,000	90,000	.0233	.0033	.....	.....	
18,800	94,000	.0267	.0034	.....	.....	
19,600	98,000	.0300	.0033	.....	.....	
20,400	102,000	.0333	.0033	.....	.....	
21,200	106,000	.0367	.0034	.....	.....	
21,600	108,000	.0400	.0033	.....	.....	
22,000	110,000	.0433	.0033	.....	.....	
22,400	112,000	.0467	.0034	.....	.....	
22,800	114,000	.0500	.0033	.....	.....	
23,200	116,000	.0567	.0067	.....	.....	
23,600	118,000	.0633	.0066	.....	.....	
24,000	120,000	.0733	.0100	.....	.....	
24,400	122,000	.0867	.0134	.....	.....	
24,480	122,400	.1133	.0266	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	122,400
Elastic limit per square inch of original section	do...	69,000
Elongation per inch after rupture	inch..	.1433
Elongation per inch under strain at elastic limit	do...	.002333
Reduction in diameter at point of rupture	do...	.055
Reduction in area after rupture, per cent of original section		20 5
Position of rupture		1″.5 from neck
Character of broken surface		fine granular, radiating from an eccentric spot
Elongation of inch sections		″.14, ″.19*, ″.10

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL SUBJECTED TO SPECIAL TREATMENT AFTER ROLLING (LENGTH OF STEMS 3″).

No. of test.	Marks.	Diameter.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation in 3 inches.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	Treatment.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Per ct.*	*Per ct.*		″ ″ ″	
5484	49.....	.564	.25	67,000	120,560	16.7	44.6	Fine silky; cup shaped.....	.29*, .13, .08	
5485	49.....	.505	.20	70,000	113,300	19.7	46.2	Fine silky	.27*, .21, .11	
5486	490 B.....	.505	.20	59,000	109,400	19.3	30.7	Granular 60 per cent; silky eccentric spot, 40 per cent.	.17, .23*, .18	Rolled, reheated in gas furnace, and annealed in charcoal.
5487	490 M	.505	.20	65,000	114,500	17.3	37.1	Fine silky	.13, .29*, .10	Do.
5488	491 B.....	.505	.20	69,000	115,600	16.7	40.3	.....do	.24*, .17, .09	Rolled, reheated in gas furnace, and annealed in lime.
5489	491 M.....	.505	.20	75,000	118,100	18.0	43.3	.....do	.10, .14, .30*	Do.
5490	492 B.....	.505	.20	61,000	124,000	11.0	16.9	Fine granular, radiating from the center.	.15*, .10, .08	Rolled, reheated in open coke fire to light cherry color, and annealed in charcoal.
5491	492 M	.505	.20	65,000	123,250	10.7	20.5	Fine granular, radiating from an eccentric spot.	.16*, .09, .07	Do.
5492	493 B.....	.505	.20	67,000	127,300	10.7	20.5	Fine granular, radiating from a point near the center.	.07, .08, .17*	Rolled, reheated in open coke fire to light cherry color, and annealed in lime.
5493	493 M	.505	.20	65,000	125,900	11.0	16.9	Fine granular, radiating from a dull silky center.	.17*, .09, .07	Do.
5494	494 B.....	.505	.20	64,000	112,250	17.7	34.0	Silky, interspersed with fine granulation.	.12, .27*, .14	Rolled, reheated in gas furnace, annealed in charcoal, reheated in open coke fire to light cherry color, and annealed in charcoal.
5495	494 M	.505	.20	65,000	112,850	17.0	34.0	Silky, with trace of granulation.....	.12, .27*, .12	Do.
5496	495 B.....	.505	.20	66,000	116,400	15.0	30.7	Silky, interspersed with fine granulation.	.09, .12, .24*	Rolled, reheated in gas furnace, annealed in charcoal, heated in open coke fire to light cherry color, and annealed in lime.
5497	495 M	.505	.20	69,000	112,100	11.7	43.3	Exceedingly fine granular, radiating from a point near center; cup shaped.	.04, .05, .26*	Do.
5498	496 B.....	.505	.20	65,000	119,800	15.0	27.4	Silky and fine granulation interspersed.	.22*, .13, .10	Rolled, annealed in charcoal, heated in open coke fire to light cherry color, and annealed in charcoal
5499	496 M	.505	.20	68,000	119,050	17.7	30.7	.....do	.13, .24*, .16	Do.
5500	497 B.....	.505	.20	63,000	120,000	13.3	27.4	Fine granular; dull silky eccentric spot.	.08, .12, .20*	Rolled, annealed in charcoal, heated in open coke fire to light cherry color, and annealed in lime.
5501	497 M	.505	.20	69,000	123,100	16.7	37.1	Silky, with trace of granulation.....	.26*, .14, .10	Do.

5502	498 B	.505	.20	56,000	114,100	15.3	27.4	Granular, irregular surface; dull spot at the circumference.	.21*, .14, .11	Rolled, annealed in air, heated in open coke fire to light cherry color, and annealed in charcoal.
5503	498 M	.505	.20	60,000	118,200	14.0	30.7	Fine granular; dull center	.08, .11, .23*	Do.
5504	499 B	.505	.20	63,000	115,500	13.7	30.7	Fine granular, 60 per cent; silky, 40 per cent.	.23*, .10, .08	Rolled, annealed in air, heated in open coke fire to light cherry color, and annealed in lime.
5505	499 M	.505	.20	71,000	115,250	17.3	37.1	Fine silky; cup shaped	.10, .17, .25*	Do.
5510	49	.564	.25	64,000	104,720	22.3	44.6	Silky; cup shaped	.15, .38*, .14	Regular stock; recent manufacture.
5511	49	.505	.20	63,000	104,900	21.0	46.2	Silky	.14, .36*, .13	Do.
5512	49 A	.505	.20	80,000	116,200	18.7	46.2	Silky; cup shaped	.11, .12, .33*	Stock heated and rolled to barrel and annealed (cooled) in air.
5513	49 A	.505	.20	83,000	123,350	17.7	46.2	do	.11, .13, .29*	Do.
5514	49 L	.505	.20	74,000	112,050	20.3	51.9	do	.12, .35*, .14	Stock heated, rolled to barrel, and annealed in lime.
5515	49 L	.505	.20	70,000	113,320	18.7	43.3	do	.26*, .19 .11	Do.
5516	49 S	.505	.20	70,000	110,900	19.7	43.3	do	.16, .32*, .11	Stock heated and rolled to barrel and annealed in sand.
5517	49 S	.505	.20	70,000	118,150	18.0	40.3	do	.12, .30*, .12	Do.
6518	57	.564	.25	77,000	124,960	18.3	44.6	do	.10, .31*, .14	Regular stock rolled in bar 1.1 inch diameter, from which barrels were made without heating.
5531	49 B	.505	.20	67,000	110,050	19.0	34.0	Silky, interspersed with fine granulation.	.17, .28*, .12	Annealed in charcoal after rolling.
5532	49 B	.505	.20	69,000	122,400	14.3	20.5	Fine granular, radiating from an eccentric spot.	.14, .19*, .10	Do.

Hardness of Rifle Barrels, Cal. .30.

The relative hardness of four half rifle barrels was determined at different places along their lengths, as indicated on the diagram following.

These several barrels were manufactured from the same lot of steel.

One of the pieces represents a new barrel which had been turned and bored but not chambered, the other pieces representing rifles which had been fired a large number of rounds and which were eroded at the bore.

The extent to which the erosion had taken place is shown by the accompanying photographs, which are magnified views of the bores just in front of the powder chambers, where the effects of erosion were located.

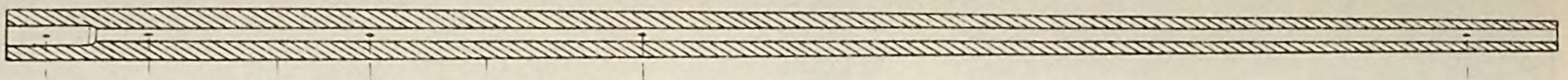
Chemical analysis of chips taken from the muzzle end of the new half barrel showed the following composition:

C	Mn	Si	S	P
0.515	1.200	0.061	0.082	0.075

The higher values for hardness found at the breech ends are attributed to the superior lateral support given the metal displaced by the indenting tool by the heavier section of metal in that vicinity over the thinner sections of the barrels found elsewhere along their length.

Hardness of Rifle Barrels, caliber 30.

Diagram showing location of hardness cuts.



Lower half of barrel. Not chambered. Same stock as other half barrels.

20 — 22 — 16 — 11 — Bore — 11

16 — 14 — Exterior

No. 42

Lower half of barrel. Fired over 2800 rounds. Bore eroded.

18 — 21 — 14 — 13 — Bore

16 — 14 — Exterior

No. 1032

Lower half of barrel. Fired 7633 rounds. Bore eroded.

18 — 22 — 16 — 14 — Bore

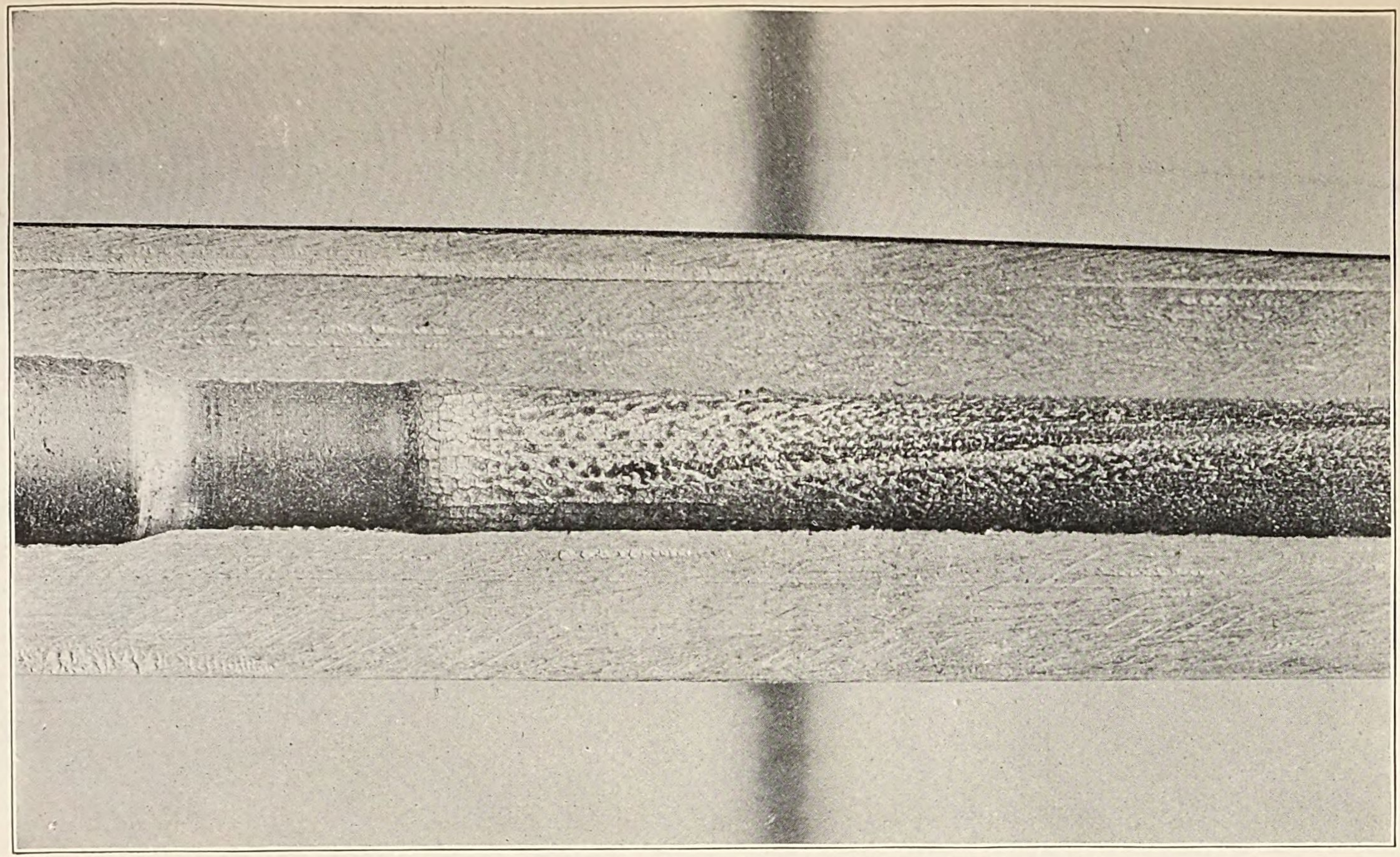
16 — 14 — Exterior

No. 87

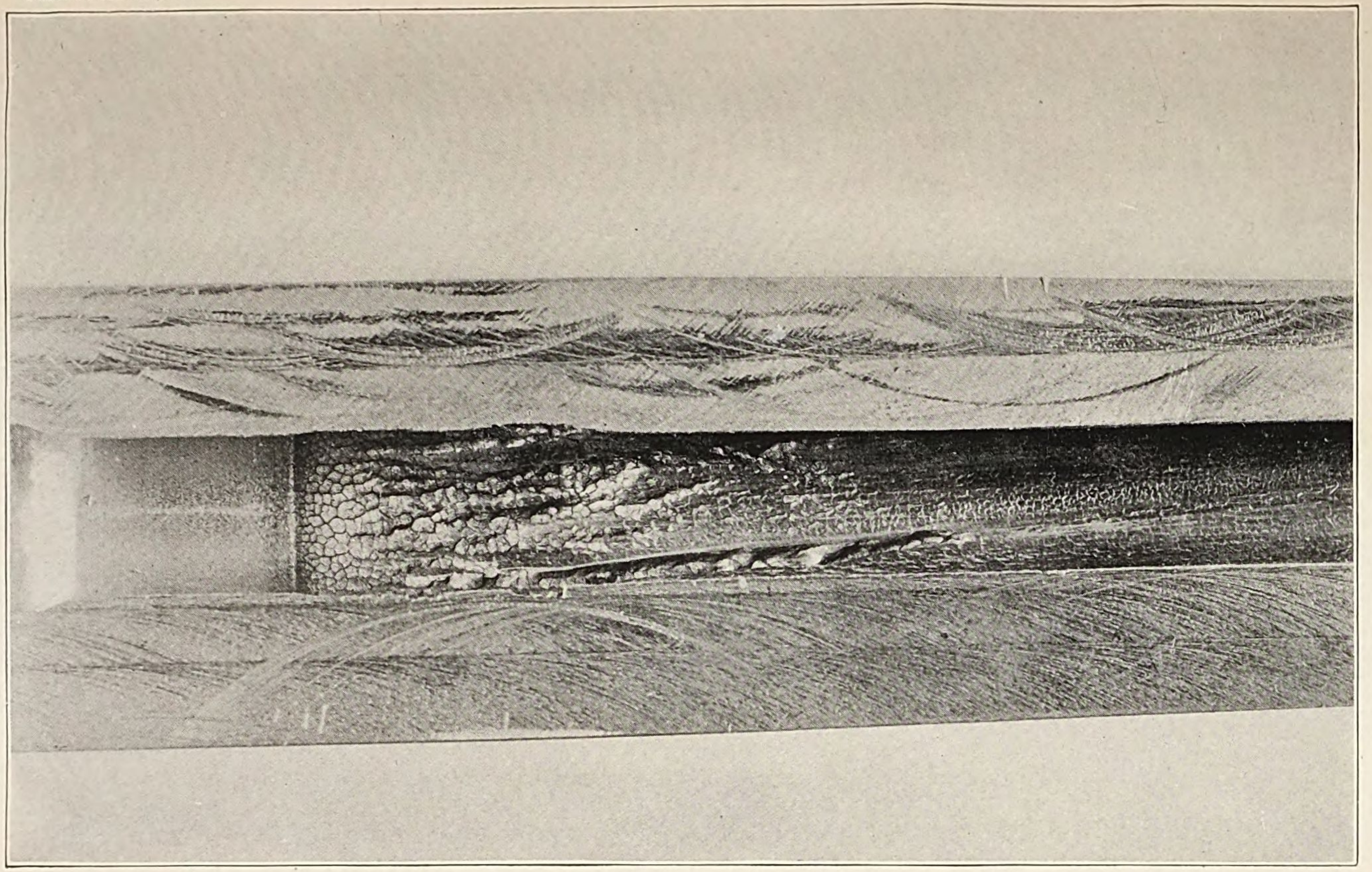
Lower half of barrel. Fired 3135 rounds. Bore badly eroded.

18 — 18 — 11 — Bore — 9

14 — 10 — Exterior



PHOTOGRAPH OF RIFLE BARREL NO. 42, SHOWING EROSION OF METAL AT SURFACE OF BORE.



PHOTOGRAPH OF RIFLE BARREL NO. 87, SHOWING EROSION OF METAL AT SURFACE OF BORE.

STEEL FOR RECEIVERS OF RIFLES, CAL. .30.

No. 5404.

TURNED DOWN FROM A BAR $2\frac{1}{4}'' \times 1''.7$.

Marks, 31 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000333	.000233	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001000	.000333	----------	----------	
10,000	40,000	.001367	.000367	0.	----------	
11,500	46,000	.001567	.000200	----------	----------	
11,750	47,000	.001600	.000033	----------	----------	Elastic limit. Load fell.
10,750	43,000	.009000	.007400	----------	----------	
11,000	44,000	.012833	.003833	----------	----------	
11,250	45,000	.013600	.000767	----------	----------	
11,500	46,000	.014733	.001133	----------	----------	
11,750	47,000	.015833	.001100	----------	----------	
12,000	48,000	.017333	.001500	----------	----------	
12,500	50,000	.020167	.002834	----------	----------	
13,000	52,000	.023333	.003166	----------	----------	
13,500	54,000	.027333	.004000	----------	----------	
14,000	56,000	.031333	.004000	----------	----------	
14,500	58,000	.035667	.004334	----------	----------	
15,000	60,000	.040333	.004666	----------	----------	
15,500	62,000	.046333	.006000	----------	----------	
16,000	64,000	.052667	.006334	----------	----------	
16,500	66,000	.060667	.008000	----------	----------	
17,000	68,000	.069333	.008666	----------	----------	
17,500	70,000	.081667	.012334	----------	----------	
18,000	72,000	.1033	.021633	----------	----------	
18,500	74,000	.1433	.0400	----------	----------	
18,630	74,520	.1767	.0334	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	74,520
Elastic limit per square inch of original section	do	47,000
Elongation per inch after rupture	inch	.2867
Elongation per inch under strain at elastic limit	do	.001600
Reduction in diameter at point of rupture	do	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".8 from neck
Character of broken surface		silky
Elongation of inch sections		".20, ".46*, ".20

No. 5405.

FORGED FROM BAR 2″.25 x 1″.7 TO DIMENSIONS FOR TURNING.

Marks, 30 R. F.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	----------	
2,500	10,000	.000333	.000233	----------	----------	
5,000	20,000	.000667	.000334	----------	----------	
7,500	30,000	.001000	.000333	----------	----------	
10,000	40,000	.001333	.000333	0.	----------	
12,000	48,000	.001600	.000267	----------	----------	
12,250	49,000	.001633	.000033	----------	----------	
12,500	50,000	.001700	.000067	----------	----------	Elastic limit. Load fell.
11,250	45,000	.002867	.001167	----------	----------	
11,500	46,000	.004167	.001300	----------	----------	
11,750	47,000	.008833	.004666	----------	----------	
12,000	48,000	.011333	.002500	----------	----------	
12,250	49,000	.012333	.001000	----------	----------	
12,500	50,000	.013333	.001000	----------	----------	
13,000	52,000	.015833	.002500	----------	----------	
13,500	54,000	.018333	.002500	----------	----------	
14,000	56,000	.022667	.004334	----------	----------	
14,500	58,000	.024667	.002000	----------	----------	
15,000	60,000	.028333	.003666	----------	----------	
15,500	62,000	.032000	.003667	----------	----------	
16,000	64,000	.036000	.004000	----------	----------	
16,500	66,000	.041000	.005000	----------	----------	
17,000	68,000	.046333	.005333	----------	----------	
17,500	70,000	.052667	.006334	----------	----------	
18,000	72,000	.061000	.008333	----------	----------	
18,500	74,000	.070667	.009667	----------	----------	
19,000	76,000	.083333	.012666	----------	----------	
19,500	78,000	.1100	.026667	----------	----------	
19,960	79,840	.1767	.0667	----------	----------	Tensile strength.

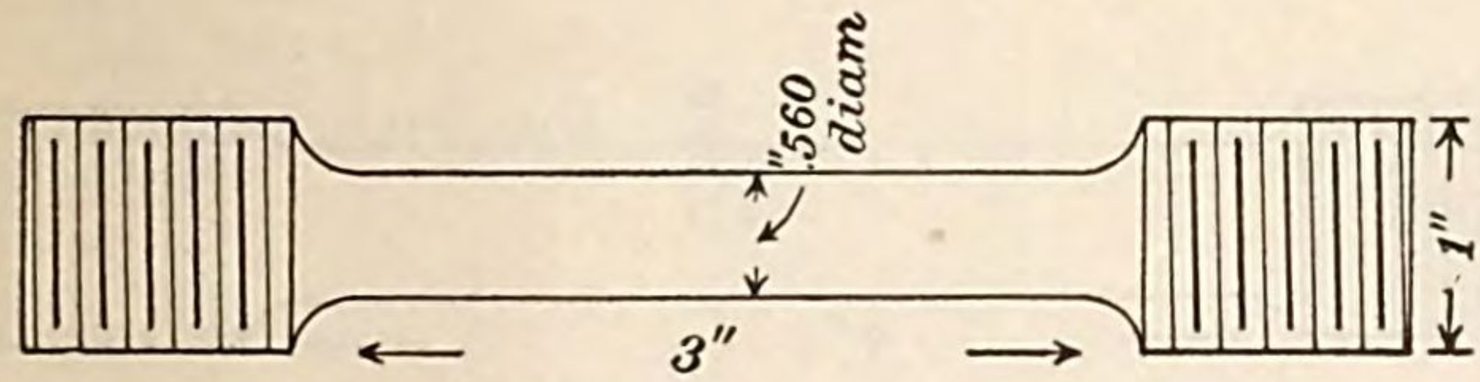
General summary.

Tensile strength per square inch of original section	pounds..	79,840
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.15 from neck
Character of broken surface		silky
Elongation of inch sections		″.33*, ″.25, ″.15

10-INCH DISAPPEARING GUN CARRIAGE, METAL USED IN CONSTRUCTION OF.

FORGED STEEL SUSPENSION ROD.

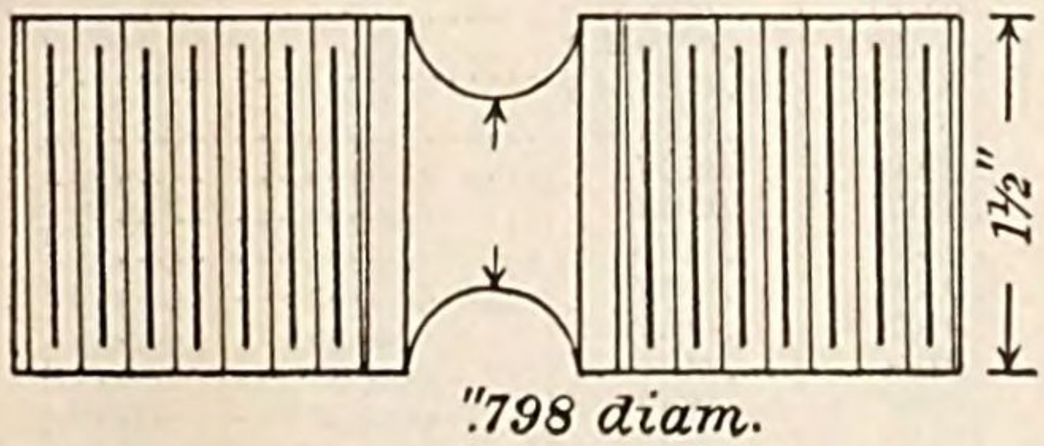
No. 8347.



Sectional area, .246 square inch.
Elastic limit, 12,590 pounds=51,180 pounds per square inch.
Tensile strength, 21,560 pounds=87,640 pounds per square inch.
Elongation in 3 inches, ".65=21.7 per cent.
Elongation of inch sections, ".39*, ".15, ".11.
Diameter at fracture, ".40; area, .126 square inch.
Contraction of area, 48.8 per cent.
Fractured ".8 from neck.
Appearance, silky.

No. 5290.

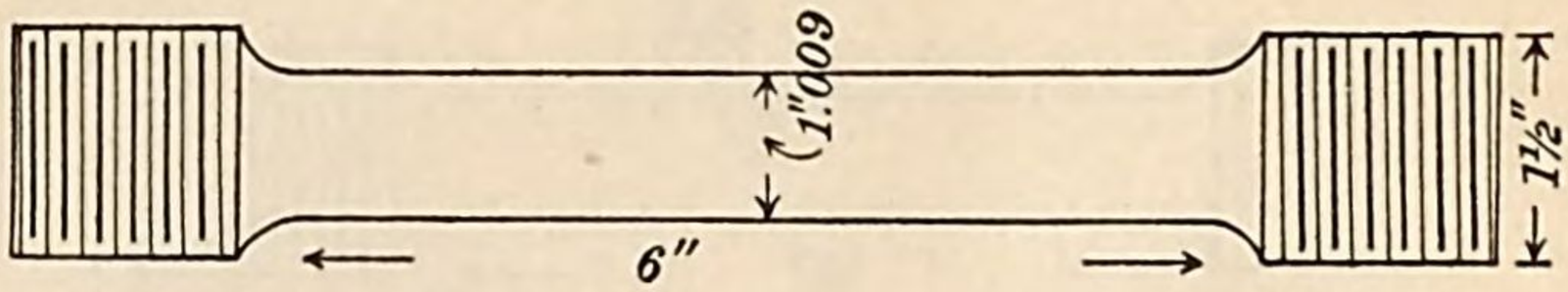
FORGED STEEL SUSPENSION ROD. TAKEN FROM SAME FORGING AS No. 8347.



Sectional area, .50 square inch.
Tensile strength, 57,580 pounds=115,160 pounds per square inch.
Appearance of fracture, fine granular.

Sample from End of Piston Rod for 10-inch Disappearing Carriage. No. 3 Steel.

No. 5519.



Diameter, 1″.009.
Sectional area, .80 square inch.
Gauged length, 6″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
800	1,000	0.	0.	0.	0.	Initial load.
4,000	5,000	.000100	.000100	.....	.....	
8,000	10,000	.000267	.000167	.....	.....	
16,000	20,000	.000617	.000350	.....	.....	
24,000	30,000	.000950	.000333	.000033	.000033	
28,000	35,000	.001100	.000150	.....	.....	
32,000	40,000	.001283	.000183	.000033	0.	
32,800	41,000	.001317	.000034	.....	.....	Elastic limit.
33,600	42,000	.001383 .005167	.000066 .003784	.....	.....	
34,400	43,000	.0083	.003133	.....	.....	
36,800	46,000	.0100	.0017	.....	.....	
40,000	50,000	.0117	.0017	.....	.....	
41,600	52,000	.0133	.0016	.....	.....	
43,200	54,000	.0150	.0017	.....	.....	
44,800	56,000	.0167	.0017	.....	.....	
46,400	58,000	.0183	.0016	.....	.....	
48,000	60,000	.0200	.0017	.....	.....	
49,600	62,000	.0217	.0017	.....	.....	
51,200	64,000	.0250	.0033	.....	.....	
52,800	66,000	.0267	.0017	.....	.....	
54,400	68,000	.0283	.0016	.....	.....	
56,000	70,000	.0317	.0034	.....	.....	
57,600	72,000	.0333	.0016	.....	.....	
59,200	74,000	.0383	.0050	.....	.....	
60,800	76,000	.0417	.0034	.....	.....	
62,400	78,000	.0450	.0033	.....	.....	
64,000	80,000	.0483	.0033	.....	.....	
65,600	82,000	.0567	.0084	.....	.....	
67,200	84,000	.0633	.0066	.....	.....	
68,800	86,000	.0683	.0050	.....	.....	
70,400	88,000	.0800	.0117	.....	.....	
72,000	90,000	.0967	.0167	.....	.....	
73,600	92,000	.1350	.0383	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	92,000
Elastic limit, per square inch of original section	do	41,000
Elongation per inch after rupture	inch	.1550
Elongation per inch under strain at elastic limit	do	.001317
Reduction in diameter at point of rupture	do	.129
Reduction in area after rupture, per cent of original section		24.0
Position of rupture		at middle of stem
Character of broken surface		granular, radiating from a silky spot at a center punch mark used in laying off inch sections on surface of stem; developed numerous minute cracks in surface of the stem.
Elongation of inch sections		″.12, ″.15, ″.26*, ″.20, ″.12, ″.08

SECOND SAMPLE TAKEN FROM SAME PISTON ROD AS NO. 5519.

No. 5522.

Stem, 3″ long.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 3″.

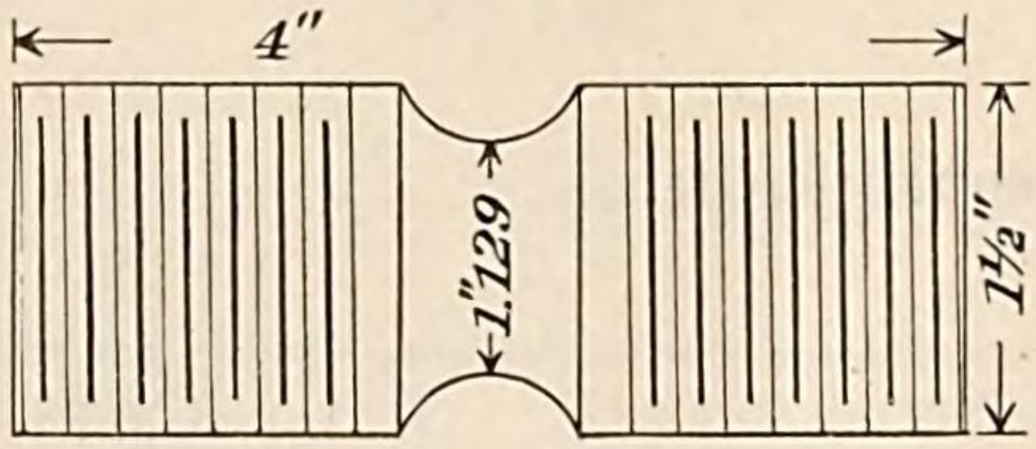
Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	0.	.....	
2,000	10,000	.000300	.000200	.....	.....	
4,000	20,000	.000633	.000333	.....	.....	
6,000	30,000	.000967	.000334	.....	.....	
8,000	40,000	.001300	.000333	0.	.....	
8,200	41,000	.001333	.000033	.....	.....	
8,400	42,000	.001367	.000034	.....	.....	Elastic limit.
8,600	43,000	.002767	.001400	.....	.....	
8,800	44,000	.005500	.002733	.....	.....	
9,000	45,000	.005933	.000433	.....	.....	
9,200	46,000	.006633	.000700	.....	.....	
9,600	48,000	.008000	.001367	.....	.....	
10,000	50,000	.009333	.001333	.....	.....	
10,400	52,000	.010000	.000667	.....	.....	
10,800	54,000	.011933	.001933	.....	.....	
11,200	56,000	.013333	.001400	.....	.....	
11,600	58,000	.014333	.001000	.....	.....	
12,000	60,000	.017333	.003000	.....	.....	
12,400	62,000	.018000	.000667	.....	.....	
12,800	64,000	.020000	.002000	.....	.....	
13,200	66,000	.022500	.002500	.....	.....	
13,600	68,000	.024000	.001500	.....	.....	
14,000	70,000	.026333	.002333	.....	.....	
14,400	72,000	.028467	.002134	.....	.....	
14,800	74,000	.031000	.002533	.....	.....	
15,200	76,000	.033667	.002667	.....	.....	
15,600	78,000	.036000	.002333	.....	.....	
16,000	80,000	.040333	.004333	.....	.....	
16,400	82,000	.043733	.003400	.....	.....	
16,800	84,000	.048333	.004600	.....	.....	
17,200	86,000	.054000	.005667	.....	.....	
17,600	88,000	.059667	.005667	.....	.....	
18,000	90,000	.068333	.008666	.....	.....	
18,400	92,000	.0867	.018367	.....	.....	
18,800	94,000	.1067	.0200	.....	.....	
18,990	94,950	.1400	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,950
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.065
Reduction in area after rupture, per cent of original section		23.9
Position of rupture		″.70 from neck
Character of broken surface		granular, 60 per cent; dull silky, 40 per cent; irregular surface; minute cracks developed in surface of stem.
Elongation of inch sections		″.22*, ″.14, ″.11

No. 5337.

SAMPLE TAKEN FROM SAME PISTON ROD AS NO. 5519.

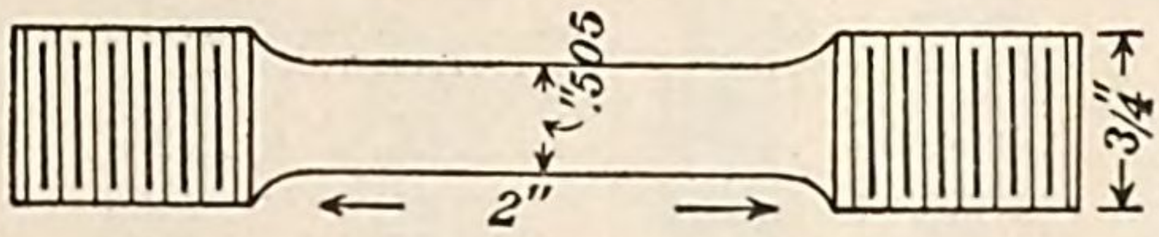


Sectional area, 1.00 square inch.
Tensile strength, 117,650 pounds per square inch.
Fractured in end at root of thread. Appearance granular.

10-inch DISAPPEARING CARRIAGE.

SPECIMENS FROM END OF GUN LEVER AXLE (CROP ENDS OF FORGINGS).

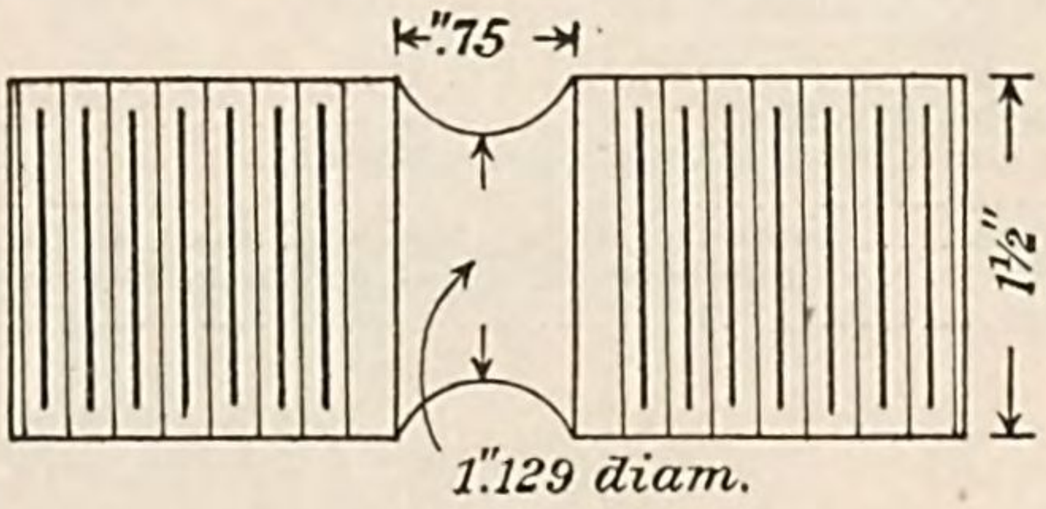
No. 8373.



Sectional area, .20 square inch.
Elastic limit, 7,700 pounds=38,500 pounds per square inch.
Tensile strength, 18,980 pounds=94,900 pounds per square inch.
Elongation in 2 inches, ".31=15.5 per cent.
Elongation of inch sections, ".12, ".19*.
Diameter at fracture, ".45; area, .159 square inch.
Contraction of area, 20.5 per cent.
Appearance of fracture, granular, with dull, silky metal.
Surface of specimen in vicinity of fracture broken with minute surface cracks.

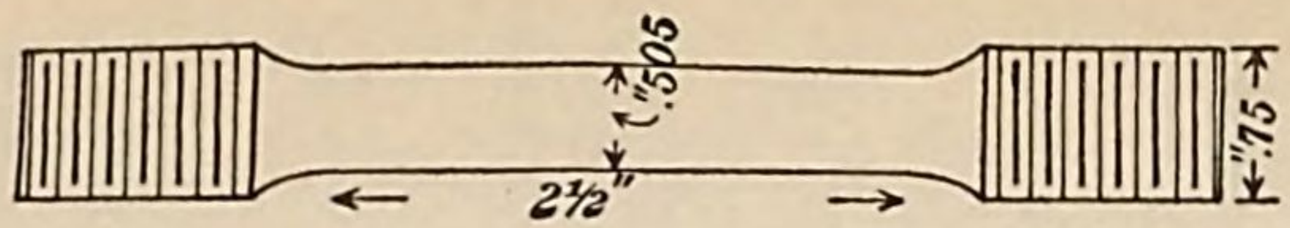
TENACITY SPECIMEN FROM SAME PIECE FROM WHENCE NO. 8373 WAS TAKEN.

No. 8374.



Sectional area, 1.00 square inch.
Tensile strength, 102,100 pounds per square inch.
Fractured at root of thread in the head. Not fractured in the grooved section.
Appearance of fracture, granular.

STEEL FOR 10-INCH DISAPPEARING CARRIAGE.

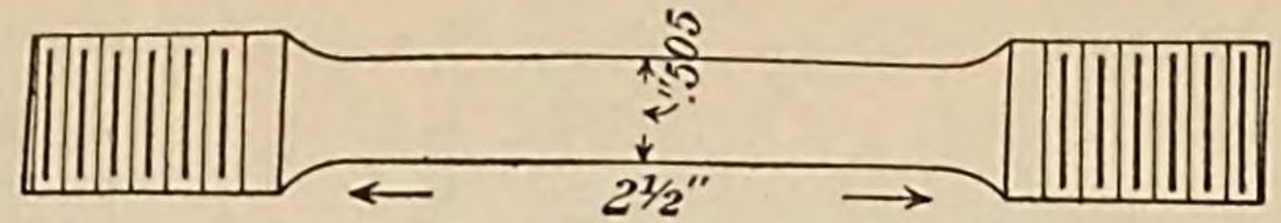


No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.	
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.					
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*In. Sq. in.*	*Per ct.*		*″*	*″*
8193	F 6851-1	.505	.20	14,000	70,000	25,060	125,300	.26	13.0	Diam. .47=.173	13.5	Fine granular	.14*	.12
8194	F 6851-2	.505	.20	11,710	58,550	20,120	100,600	.46	23.0	Diam. .38=.113	43.5	Silky, with traces of granulation.	.32*	.14
8195	F 6725-3	.505	.20	10,700	53,500	17,990	89,950	.55	27.5	Diam. .37=.108	46.0	Silky	.32*	.23
8196	F 6929-4	.505	.20	11,120	55,600	18,230	91,150	.49	24.5	Diam. .40=.126	37.0	do	.33*	.16
8197	F 6937-5	.505	.20	11,080	55,400	18,130	90,650	.54	27.0	Diam. .36=.102	49.0	do	.37*	.17
8198	F 6938-6	.505	.20	11,990	59,950	19,890	99,450	.53	26.5	Diam. .37=.108	46.0	do	.23	.30*
8199	F 6938-7	.505	.20	12,950	64,750	22,280	111,400	.41	20.5	Diam. .42=.139	30.5	Silky, interspersed with fine granulation.	.13	.28*
8200	F 6938-F 8	.505	.20	11,700	58,500	19,130	95,650	.54	27.0	Diam. .37=.108	46.0	Silky	.35*	.19
8201	F 6938-9	.505	.20	11,520	57,600	18,590	92,950	.57	28.5	Diam. .36=.102	49.0	do	.35*	.22
8202	F 6938-10	.505	.20	11,350	56,750	18,790	93,950	.61	32.0	Diam. .37=.108	46.0	do	.17	.47*
8203	F 6938-11	.505	.20	11,480	57,400	18,660	93,300	.56	28.0	Diam. .36=.102	49.0	do	.18	.38*
8204	F 6938-12	.505	.20	11,260	56,300	18,970	94,850	.54	27.0	Diam. .37=.108	46.0	do	.17	.37*
8205	F 6938-13	.505	.20	13,290	66,450	21,920	109,600	.37	18.5	Diam. .41=.132	34.0	Silky, interspersed with fine granulation.	.26*	.11
8206	F 6894-14	.505	.20	11,130	55,650	19,110	95,550	.46	23.0	Diam. .40=.126	37.0	Silky	.30*	.16
8207	F 6890-15	.505	.20	12,810	64,050	20,020	100,100	.49	24.5	Diam. .40=.126	37.0	Silky, with traces of granulation.	.18	.31*
8208	F 6890-16	.505	.20	12,080	60,400	20,100	100,500	.44	22.0	Diam. .40=.126	37.0	do	.15	.29*
8209	F 6890-17	.505	.20	14,070	70,350	23,790	118,950	.19	9.5	Diam. .48=.181	9.5	Fine granular	.09	.10*
8210	F 6890-18	.505	.20	10,950	54,750	18,800	94,000	.50	25.0	Diam. .38=.113	43.5	Silky	.35*	.15
8211	F 6853-19	.505	.20	11,980	59,900	19,720	98,600	.45	22.5	Diam. .39=.119	40.5	do	.14	.31*

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inch. Sq. in.*	*Per ct.*		" "
8342	20, F 6851	.505	.20	12,550	62,750	20,640	103,200	.41	20.5	Diam. .41 = .132	34.0	Fine granular	.14, .27*
8343	21, F 6890	.505	.20	12,100	61,500	19,020	95,100	.50	25.0	Diam. .36 = .102	49.0	Fine silky	.35*, .15
8344	22, F 6890	.505	.20	14,200	71,000	24,100	120,500	.35	17.5	Diam. .45 = .159	20.5	Fine granular	.22*, .13
8350	P 12865, 1	.505	.20	7,910	39,550	17,620	88,100	.38	19.0	Diam. .44 = .152	24.0	Granular, dull spot at circumference.	.23*, .15
8351	P 12865, 2	.505	.20	7,950	39,750	18,210	91,050	.41	20.5	Diam. .44 = .152	24.0	do	.24*, .17

Specimens 8342, 8343, and 8344 have the general mark 7192.

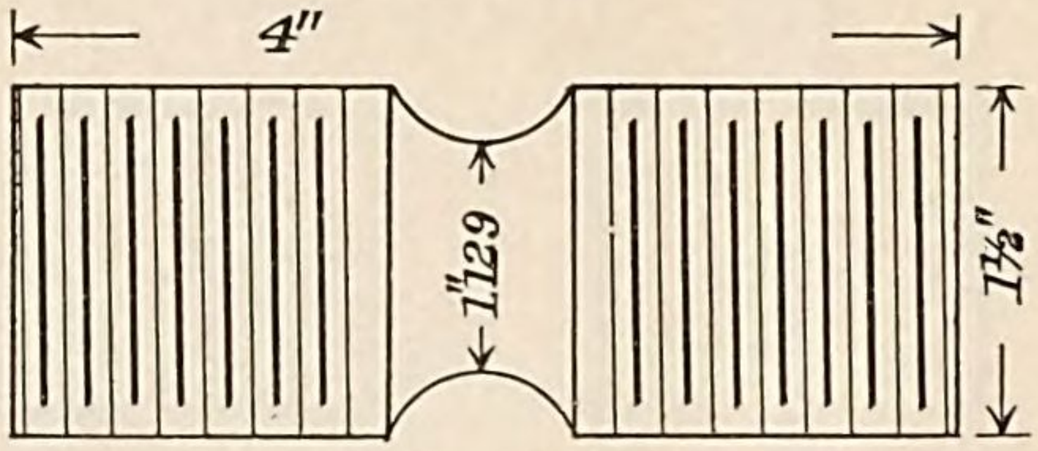
Wrought Iron for 10-Inch Disappearing Carriage.



[All specimens have the general mark 7192.]

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 2 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inch.	Per cent.				
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inch. Sq. in.*	*Per ct.*		" "
8334	1, F 6963	.505	.20	6,480	32,400	10,180	50,900	.67	33.5	Diam. .37 = .107	46.5	Fibrous	.44*, .23
8335	2, F 6963	.505	.20	6,070	30,350	9,830	49,150	.66	33.0	Diam. .36 = .102	49.0	do	.23, .43*
8336	3, F 6963	.505	.20	5,990	29,950	9,920	49,600	.70	35.0	Diam. .37 = .107	46.5	do	.28, .42*
8337	4, F 6963	.505	.20	5,990	29,950	9,910	49,550	.66	33.0	Diam. .37 = .107	46.5	do	.25, .41*
8338	5, F 6963	.505	.20	5,780	28,900	9,660	48,300	.59	29.5	Diam. .39 = .119	40.5	do	.21, .38*
8339	6, F 6963	.505	.20	6,240	31,200	10,120	50,600	.69	34.5	Diam. .38 = .113	43.5	do	.42*, .27
8340	7, F 6963	.505	.20	5,680	28,400	9,530	47,650	.73	36.5	Diam. .37 = .107	46.5	do	.42, .31
8341	8, F 6963	.505	.20	6,450	32,250	9,970	49,850	.65	32.5	Diam. .38 = .113	43.5	do	.23, .42*

Cast Iron Used in Construction of 10″ Disappearing Carriage.



No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
5261	20	1.129	1.00	24,920	24,920	Fine granular, dark gray.
5269	1, P–12840	1.129	1.00	14,480	14,480	Do.
5270	do	1.129	1.00	14,070	14,070	Do.
5271	2, P–12840	1.129	1.00	20,010	20,010	Do.
5272	do	1.129	1.00	19,600	19,600	Do.
5273	3, P–12840	1.129	1.00	15,990	15,990	Do.
5274	do	1.129	1.00	16,300	16,300	Do.
5275	4, P–12840	1.129	1.00	14,780	14,780	Do.
5276	do	1.129	1.00	15,100	15,100	Do.
5277	5, P–12840	1.129	1.00	19,300	19,300	Do.
5278	do	1.129	1.00	18,320	18,320	Do.
5279	6, P–12840	1.129	1.00	16,630	16,630	Do.
5280	do	1.129	1.00	16,050	16,050	Do.
5281	7, P–12840	1.129	1.00	13,400	13,400	Do.
5282	do	1.129	1.00	13,490	13,490	Do.
5283	8, P–12840	1.129	1.00	13,380	13,380	Do.
5284	do	1.129	1.00	13,810	13,810	Do.

Cast Iron for Counterweight Base Plate, 10″ Disappearing Carriage.

No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
5305	P 12840–9	.81	.515	8,110	15,750	Fine granular, gray.
5306	do	.81	.515	8,990	17,460	Do.
5331	12840–10	1.129	1.00	18,330	18,330	Fine granular, dark gray; one side medium fine granular.
5332	do	1.129	1.00	16,380	16,380	Do.

Base Ring and Traverse Circle for 10″ Disappearing Carriage.

No. of test.	Numbers.	Diameter.	Sectional area.	Tensile strength.		Appearance of fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
5233	1 A	1.129	1.00	33,950	33,950	Fine granular, dark gray, spongy spo' near circ.
5234	1 B	1.129	1.00	33,120	33,120	Fine granular.
5235	1 C	1.129	1.00	34,280	34,280	Do.
a 5307		1.129	1.00	36,810	36,810	Fine granular, granitic.

a Has stem 9½ inches long; other specimens are grooved form.

CAST IRON.

CASTING OF BASE RING AND REAR TRAVERSE CIRCLE.

No. 5388.

Marks, D_2.
Diameter, 1″.135.
Sectional area, 1.01 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,010	1,000	0.	0.	0.	0.	Initial load.
2,020	2,000	.00007	.00007	----------	----------	
3,030	3,000	.00012	.00005	----------	----------	
4,040	4,000	.00020	.00008	----------	----------	
5,050	5,000	.00028	.00008	0.	----------	
6,060	6,000	.00036	.00008	----------	----------	
7,070	7,000	.00045	.00009	----------	----------	
8,080	8,000	.00054	.00009	----------	----------	
9,090	9,000	.00064	.00010	----------	----------	
10,100	10,000	.00077	.00013	.00008	.00008	
11,110	11,000	.00089	.00012	----------	----------	
12,120	12,000	.00102	.00013	----------	----------	
13,130	13,000	.00119	.00017	----------	----------	
14,140	14,000	.00137	.00018	----------	----------	
15,150	15,000	.00159	.00022	.00040	.00032	
16,160	16,000	.00184	.00025	----------	----------	
17,170	17,000	.00218	.00034	----------	----------	
18,180	18,000	.00261	.00043	----------	----------	
19,190	19,000	.00309	.00048	----------	----------	
20,200	20,000	.00385	.00076	.00203	.00163	
21,210	21,000	.00498	.00113	----------	----------	Tensile strength.

Fractured at the neck. Appearance fine granular.

CAST IRON.

No. 5389.

Marks, E 3.
Diameter, 1″.135.
Sectional area, 1.01 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,010	1,000	0.	0.	0.	0.	Initial load.
2,020	2,000	.00005	.00005	------	------	
3,030	3,000	.00010	.00005	------	------	
4,040	4,000	.00016	.00006	------	------	
5,050	5,000	.00021	.00005	0.	------	
6,060	6,000	.00029	.00008	------	------	
7,070	7,000	.00034	.00005	------	------	
8,080	8,000	00041	.00007	------	------	
9,090	9,000	.00048	.00007	------	------	
10,100	10,000	.00055	.00007	.00002	.00002	
11,110	11,000	.00061	.00006	------	------	
12,120	12,000	.00070	.00009	------	------	
13,130	13,000	.00078	.00008	------	------	
14,140	14,000	.00084	.00006	------	------	
15,150	15,000	.00093	.00009	.00010	.00008	
16,160	16,000	.00103	.00010	------	------	
17,170	17,000	.00113	.00010	------	------	
18,180	18,000	.00124	.00011	------	------	
19,190	19,000	.00134	.00010	------	------	
20,200	20,000	.00150	.00016	.00029	.00019	
21,210	21,000	.00163	.00013	------	------	
22,220	22,000	.00179	.00016	------	------	
23,230	23,000	.00200	.00021	------	------	
24,240	24,000	.00220	.00020	------	------	
25,250	25,000	.00244	.00024	.00078	.00049	
26,260	26,000	.00272	.00028	------	------	
27,270	27,000	.00311	.00039	------	------	
28,280	28,000	.00354	.00043	------	------	
29,290	29,000	.00409	.00055	------	------	
30,300	30,000	.00476	.00067	.00254	.00176	
31,980	31,660	------	------	------	------	Tensile strength.

Fractured at the neck. Appearance fine granular.

PROOF STRESS APPLIED TO PISTON RODS FOR 10″ DISAPPEARING CARRIAGES.

The rods were secured in the testing machine at one end by means of the nuts on the rods, at the other end by friction grip.

Finished rods turned to 4″ diameter.

Unfinished rods turned to 4″.06 diameter.

Tensile stress applied 116,000 pounds total.

No. of test.	Marks.	Condition.	Manufacturer.
8375	6582 B_3 F_1	Finished	Kilby Manufacturing Co., Cleveland, Ohio.
8376	6582 B_4 F_1	do	
8377	6582 B_3 F_2	Unfinished	
8378	6582 B_4 F_2	do	
8379	6040 B_3 F_2	Finished	The Bethlehem Iron Co., South Bethlehem, Pa.
8380	6493 B_6 F_1	do	
8381	6493 B_7 F_2	do	
8382		do	
8383		do	
8384		do	
8385	6 rods, no marks	Finished except threading.	Watertown Arsenal shops.

PROOF STRESS APPLIED TO EIGHT SUSPENSION RODS FOR 10″ DISAPPEARING CARRIAGES.

Rods from Watertown Arsenal shops.

Rods 4½″ diameter with eyes 8″ diameter.

Secured in the testing machine by friction grip over heads, and by pulling against nut at opposite end.

Tensile stress applied 175,000 pounds total.

PROOF STRESS APPLIED TO TWO PISTON RODS FOR 15″ GUN CARRIAGES, OLD MODEL.

Diameter of rods, 3″.

Diameter at end carrying nut, 2″.90.

Diameter at root of thread, 2″.70.

Loaded against nut at one end and collars of cross head at the other.

No. 8511.

Two hundred and ten thousand pounds tension applied, causing a permanent set of ″.32.

No. 8512.

Two hundred and ten thousand pounds tension applied, causing a permanent set of ″.26.

STEEL FOR USE IN CONSTRUCTION OF ROCK ISLAND BRIDGE.

No. 5472.

Marks, 2″.
Diameter, ″.564.
Sectional area, .25 square inch.
Length of stem, 8″.
Gauged length, 6″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	----------	
2,500	10,000	.000317	.000167	----------	----------	
5,000	20,000	.000650	.000333	----------	----------	
7,500	30,000	.000983	.000333	0.	----------	
9,500	38,000	.001267	.000284	.000033	.000033	Elastic limit. Load fell.
8,750	35,000	.004083	.002816	----------	----------	
9,000	36,000	.006000	.001917	----------	----------	
9,250	37,000	.009167	.003167	----------	----------	
9,500	38,000	.019000	.009833	----------	----------	
9,750	39,000	.019600	.000600	----------	----------	
10,000	40,000	.021300	.001700	----------	----------	
10,250	41,000	.022417	.001117	----------	----------	
10,500	42,000	.024383	.001966	----------	----------	
10,750	43,000	.026333	.001950	----------	----------	
11,000	44,000	.028333	.002000	----------	----------	
11,500	46,000	.032833	.004500	----------	----------	
12,000	48,000	.0400	.007167	----------	----------	
12,500	50,000	.0467	.0067	----------	----------	
13,000	52,000	.0550	.0083	----------	----------	
13,500	54,000	.0633	.0083	----------	----------	
14,000	56,000	.0750	.0117	----------	----------	
14,500	58,000	.0950	.0200	----------	----------	
15,000	60,000	.1167	.0217	----------	----------	
15,500	62,000	.1783	.0616	----------	----------	
15,540	62,160	.2183	.0400	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	62,160
Elastic limit per square inch of original section	do	38,000
Elongation per inch after rupture (in 8 inches)	inch	.2425
Elongation per inch under strain at elastic limit	do	.001267
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		3″.1 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.22, ″.43*, ″.25, ″.24, ″.22, ″.20, ″.20

No. 5473.

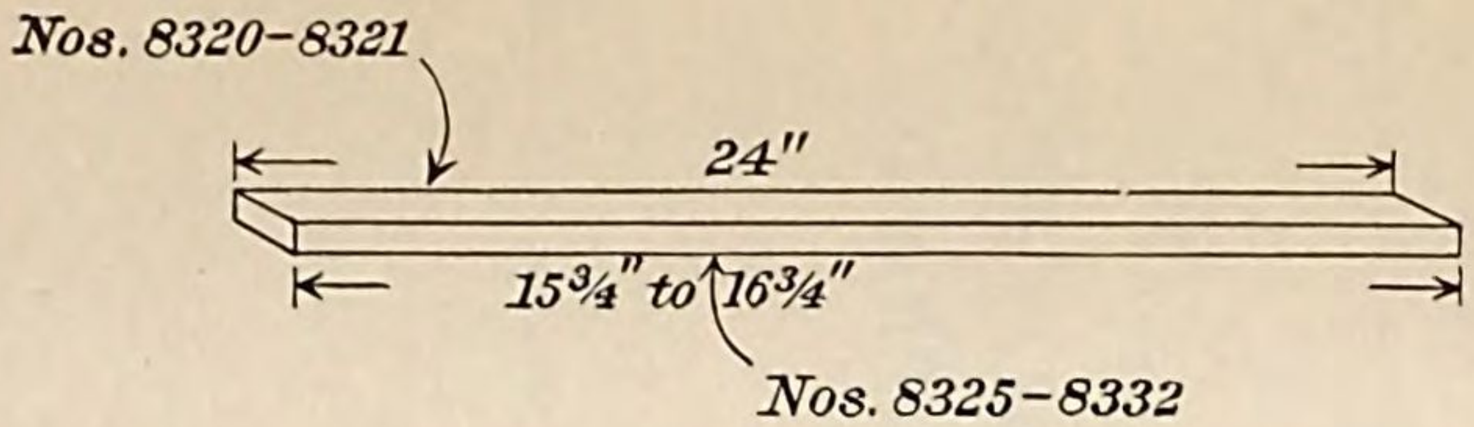
Marks, 6.
Diameter, ″.564.
Sectional area, .25 square inch.
Length of stem, 8″.
Gauged length, 6″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000150	.000150	0.	----------	
2,500	10,000	.000317	.000167	----------	----------	
5,000	20,000	.000667	.000350	----------	----------	
7,500	30,000	.001017	.000350	.000017	.000017	
8,750	35,000	.001200	.000183	.000033	.000016	
9,000	36,000	.001233	.000033	----------	----------	Elastic limit.
9,250	37,000	.001333	.000100	----------	----------	
						Load fell.
8,750	35,000	.002033	.000700	----------	----------	
9,000	36,000	.005333	.003300	----------	----------	
9,250	37,000	.016667	.011334	----------	----------	
9,500	38,000	.017867	.001200	----------	----------	
9,750	39,000	.019000	.001133	----------	----------	
10,000	40,000	.020967	.001967	----------	----------	
10,500	42,000	.025033	.004066	----------	----------	
11,000	44,000	.028333	.003300	----------	----------	
11,500	46,000	.0333	.004967	----------	----------	
12,000	48,000	.0400	.0067	----------	----------	
12,500	50,000	.0467	.0067	----------	----------	
13,000	52,000	.0533	.0066	----------	----------	
13,500	54,000	.0633	.0100	----------	----------	
14,000	56,000	.0733	.0100	----------	----------	
14,500	58,000	.0900	.0167	----------	----------	
15,000	60,000	.1167	.0267	----------	----------	
15,500	62,000	.1633	.0466	----------	----------	
15,570	62,280	.1983	.0350	----------	----------	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	62,280
Elastic limit per square inch of original section	do	36,000
Elongation per inch after rupture (in 8 inches)	inch	.2538
Elongation per inch under strain at elastic limit	do	.001233
Reduction in diameter at point of rupture	do	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		4″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.19, ″.26, ″.28, ″.28, ″.44*, ″.22, ″.19, ′.17

STEEL PLATE.



No. of test.	Mark on specimen.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
				Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*In. In. Sq. in*	*P. ct.*		
8320	2.....	1.498	.371	.556	18,120	32,590	33,040	59,420	2.46	24.6	1.15×.26=.299 ...	46.2	Silky	″.17, ″.17, ″.20, ″.23, ″.58*, ″.28, ″.20, ″.20, ″.22, ″.21.
8321	6.....	1.500	.372	.558	17,450	31,270	32,810	58,800	2.68	26.8	1.14×.25=.285 ...	48.9	....do	″.23, ″.53*, ″.35, ″.24, ″.19, ″.23, ″.23, ″.27, ″.22, ″.19.
8325	1.....	1.488	.499	.742	27,180	36,630	47,910	64,570	.....	.....	.....	.....	....do	
8326	3.....	1.494	.502	.750	26,450	35,270	48,020	64,030	.....	.....	.....	.....	....do	
8327	6.....	1.494	.493	.737	25,580	34,710	47,210	64,060	.....	.....	.....	.....	....do	
8328	8.....	1.495	.499	.746	25,560	34,260	47,140	63,190	.....	.....	.....	.....	....do	
8329	A1.....	1.301	.763	.993	39,900	40,180	61,680	62,110	.....	.....	.....	.....	....do	
8330	A2.....	1.306	.760	.993	37,520	37,780	59,310	59,730	.....	.....	.....	.....	....do	
8331	C1	1.254	.760	.953	40,200	42,180	61,850	64,900	.....	.....	.....	.....	....do	
8332	C2	1.256	.761	.956	41,200	43,100	59,110	61,830	.....	.....	.....	.....	....do	

THE RESISTANCE OF BANDED SHELLS WHEN FORCED THROUGH THE BORES OF RIFLED GUNS.

THE RESISTANCE OF BANDED SHELLS WHEN FORCED THROUGH THE BORES OF RIFLED GUNS.

Guns of five different calibers are represented in these tests—3.2-inch B. L. field guns, 5-inch B. L. siege rifle, 7-inch B. L. siege howitzer, 8-inch B. L. seacoast gun, and 10-inch B. L. seacoast gun.

Through the bore of these guns copper banded shells were forced, and the resistance of the shell measured at frequent intervals along the length of travel in the guns.

The 3.2-inch, 5-inch, and 7-inch guns were experimented upon in the testing machine; the two larger caliber guns were experimented with in the arsenal erecting shop.

The resistances in the latter two were ascertained with a pressure gauge attached to hydraulic piping near the powder chamber. A piston with leather packing in the powder chamber afforded the necessary means for forcing the shell along the bore, followers being introduced between the piston and the shell as the stroke of the piston, limited by the powder chamber, was successively exhausted.

The rate of piston speed was .093 foot per minute in the 8-inch gun and .053 foot per minute in the 10-inch gun, these rates of speed being maintained throughout each of these two experiments.

The guns experimented upon with the testing machine had their shells pushed through the bores by means of a long follower. It was necessary, however, to interrupt the tests after each 24 inches travel, to permit taking a new stroke with the piston of the testing machine.

The rate of travel of the shells ranged from .2 to .4 foot per minute, in some instances exceeding .5 foot per minute.

At the commencement of each test the shells were forced very slowly until the bands were fully engaged in the rifling. During the remainder of each test a more rapid travel of the shell was maintained.

A first crest in the resistance was found when the travel of the shell was between the limit of about ″.40 to ″.70. The second crest occurred when the shell reached about the end of the forcing cone in those guns which had this feature.

In the model of 1890, rifling of increasing twist, a second and higher crest was found at 6 inches travel, and in the Driggs-Schroeder gun the second crest occurred at about the same place, but in the latter gun some of these subsequent waves of increased resistance did not reach so high limits as those first met.

The bore of the gun, model 1885, was not in so smooth condition as the other two guns of the same caliber, and to this cause is attributed the higher resistance of the shells in the bore.

Three blank cartridges, 1 pound mortar powder each, were fired in model 1885 gun, for the purpose of fouling the bore. The resistance of the shell in the test which followed reached the maximum 107,100 total pounds, or 13,317 pounds per square inch on the base of the shell.

After passing the crests of high resistance there was a gradual tendency to decrease the resistance, as the shell traveled along the chase of the guns.

There were instances in which a sharp increase occurred when the band had nearly reached the muzzle of the gun, which was attributed to the point of the shell falling, having passed out of the bore, a wedge action taking place.

The resistance of the band was in some degree dependent upon the manipulation of the testing machine.

Under a fairly uniform rate of speed the resistance of the shell was not subject to wide variations. When the travel of the shell was stopped at the end of each stroke of the piston of the testing machine, the cessation of motion was frequently accompanied by a decided increase in the resistance of the shell.

After the piston had stopped for an interval of several minutes the seemingly reflex action of the copper band continued, and further increased the load which was on the base of the shell.

There was usually a momentary increase in resistance accompanying the beginning of a new stroke of the piston.

In test No. 8357, 7-inch howitzer, the speed of the shell was intentionally varied so as to maintain a resistance of 70,000 pounds for a time, and then by a slow piston movement the resistance was maintained at 60,000 pounds.

Experiments were made with special bands on 3.2-inch shell, which were forced through the Driggs-Schroeder gun.

These bands offered less metal to shear and displace by the lands of the gun than the regular bands, and lower resistances were found in their use.

In the following table are shown the maximum resistance and the distance the shell had traveled at the time, in the different experiments. Where two sets of figures are given, they refer to the two crests of high resistance shown in the same experiment.

Only those experiments are indicated in this table where the regular bands were used.

The pressures per square inch are computed on the nominal diameter of the bore of gun.

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1885.

No. of test.	Travel of shell.	Resistance.		Remarks.
		Total.	Per square inch.	
	Inches.	*Pounds.*	*Pounds.*	
8393	0.64+	99,200	12,335	
8394	.72	72,900	9,064	
8395	.68	72,500	9,015	
8396	.62	70,600	8,779	Gun fouled.
	7.00	107,100	13,317	
8399	.45	56,800	7,063	
8400	.54	51,000	6,342	

3.2-INCH DRIGGS-SCHROEDER B. L. STEEL FIELD RIFLE.

8391	0.37	37,000	4,601	
	6.00	26,600	3,308	
8392	.43	41,300	5,136	
	6.00	38.300	4,762	
8402	.45	38,600	4,800	
	8.00	40,600	5,048	
8403	.37	44,200	5,496	
	6.00	40,400	5,203	
8552	.41	41,400	5,148	
	10.00	60,000	7,461	

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1890.

8628	0.38	45,600	5,670	
	6.00	51,000	6,342	
	9.33+	60,400	7,510	Momentary.
8629	.40	37,100	4,613	
	6.00	44,800	5,571	

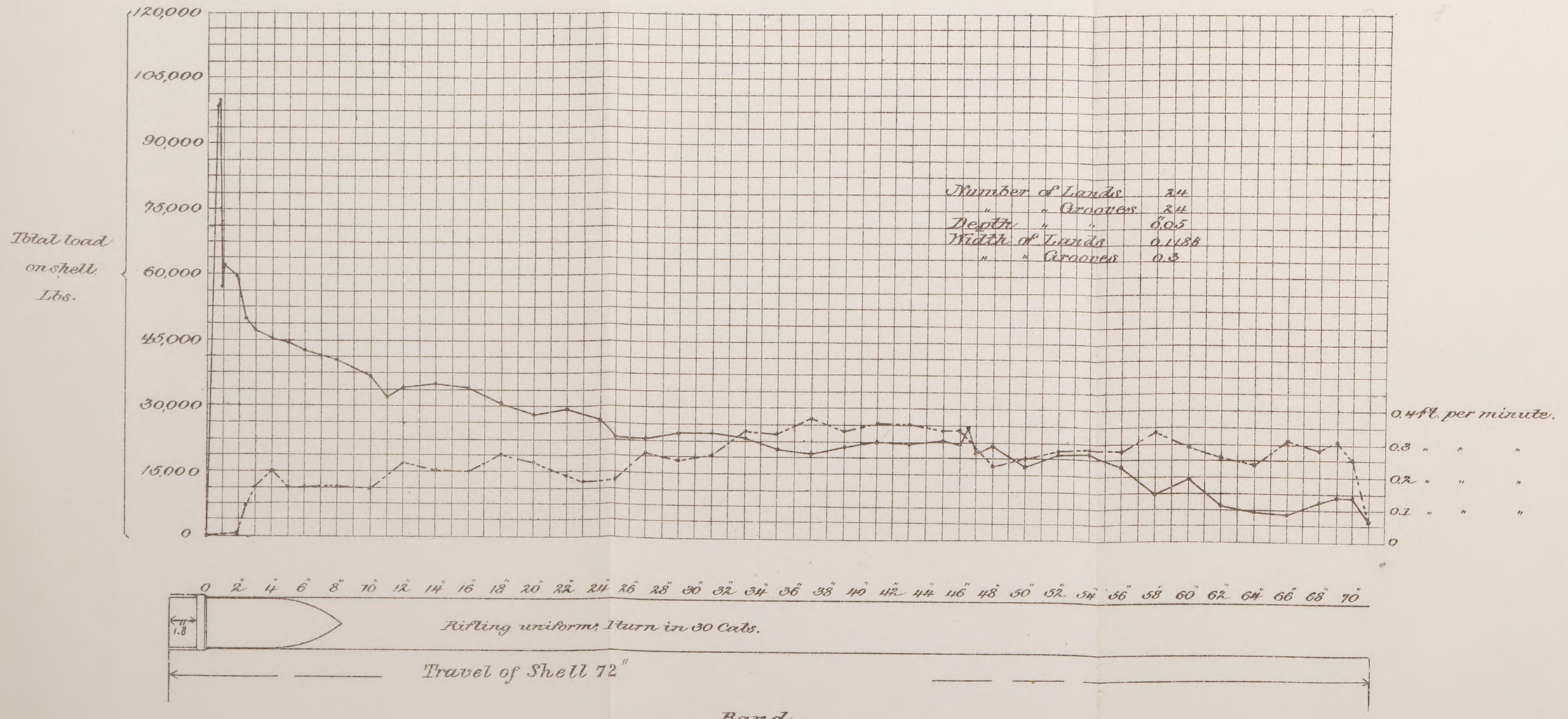
No. 8393.

3.2-inch B.L. Steel Field Rifle

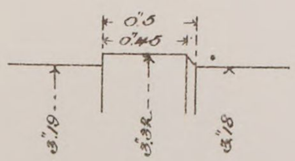
Model 1885.

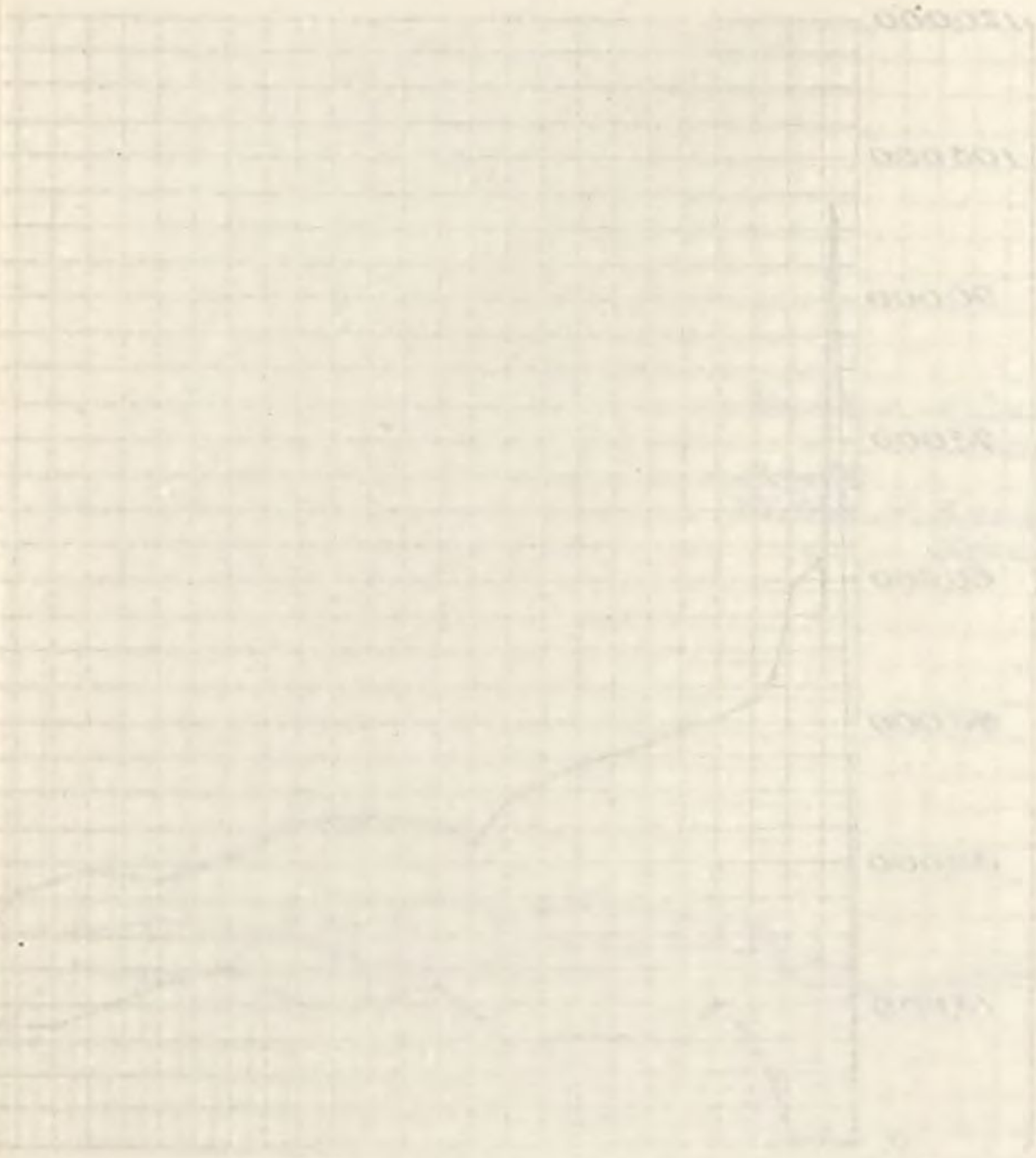
Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band.





5-INCH B. L. STEEL SIEGE RIFLE. MODEL 1890.

8369	0.58	89,000	4,533	
	15.50	104,200	5,307	
8370	.55	68,500	3,489	
	14.00	103,300	5,261	

7-INCH B. L. STEEL SIEGE HOWITZER. MODEL 1890.

8357	0.70	88,600	2,302	
	21.30	85,000	2,209	
8358	.60+	100,500	2,611	
	18.87	103,700	2,694	
8361	.80	129,000	3,352	
	20.00±	138,000	3,586	

8-INCH B. L. RIFLE, STEEL. MODEL 1888.

8371	1.50	243,120	4,837	
	25.50±	188,540	3,751	

10-INCH B. L. RIFLE, STEEL. MODEL 1888, MODIFIED.

8504	1.50	312,770	3,982	
	52 to 54	265,200	3,377	

On the diagrams, the full lines represent the curves of resistance, the dotted lines the curves of velocity of the shells.

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1885.

No. 8393.

Gun branded at muzzle { "Watervliet Arsenal.
830 lbs. No. 26.
I. M. 1890."

Dimensions of band same as in test No. 8391.
Shell pushed through the gun.
Bore of gun in a thoroughly greased condition.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
Pounds.	*Inches.*	*Foot.*	*h.*	*m.*	*s.*	
1,000	0.	.....	3	34	45	
5,000	.02	.....		35	00	
10,000	.05	.....		35	25	
15,000	.08	.....		35	45	
20,000	.10	.....		36	15	
30,000	.16	.....		36	50	
40,000	.22	.....		37	30	
50,000	.27	.....		38	35	
55,000	.30	.....		39	20	
60,000	.34	.....		40	05	
65,000	.36	.....		40	45	
70,000	.39	.....		41	40	
75,000	.42	.....		42	20	
80,000	.46	.....	3	43	00	
90,000	.54	.....		44	15	
95,300	.62	.....		45	10	
98,300	.64	0.005		45	45	

No. 8393—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
99,200	.....	.....	.....	Throb, and load fell. Then followed a series of throbs, the load fluctuating between 70,000 and 85,000 pounds.
72,000	.97	.009	3 48 00	
				Test interrupted to recenter follower.
			3 56 00	Test resumed.
74,000	.....	.....	57 00	Throb; load fell.
57,000	1.00			
62,000	1.02	.....	.....	Throb.
59,400	1.90	.022	3 59 30	
50,000	2.45	.092	4 00 00	
47,200	3.00	.153	00 18	
45,600	4.00	.208	00 42	
44,500	5.00	.152	01 15	
42,800	6.00	.152	01 48	
40,200	8.00	.154	02 53	
36,200	10.00	.149	04 00	
				Follower again recentered.
.....	.....	.....	4 08 15	Test resumed.
36,500	.....	.....	.....	Throb.
32,000	11.00	.091	4 09 10	
34,000	12.00	.227	09 32	
35,000	14.00	.208	10 20	
34,000	16.00	.200	11 10	
30,600	18.00	.250	11 50	
28,300	20.00	.227	12 34	
29,200	22.00	.182	13 29	
28,100	23.00	.172	13 58	
				New stroke of piston.
29,000	.....	.....	4 22 50	Test resumed.
27,200	24.00	.....	23 40	}
23,100	25.00	.179	24 08	
22,800	27.00	.263	24 46	} Throbs.
24,200	29.00	.238	25 28	
24,200	31.00	.278	26 04	
23,100	33.00	.333	26 34	}
21,000	35.00	.323	27 05	Throbs nearly ceased.
19,800	37.00	.370	27 32	}
21,500	39.00	.333	28 02	
22,500	41.00	.357	28 30	} Throbs, less violent.
22,400	43.00	.357	28 58	
22,600	45.00	.333	29 28	
22,100	46.00	.333	29 43	
				New stroke of piston.
.....	.....	.....	4 38 10	Test resumed.
26,000	.....	.....	.....	Maximum momentary resistance.
19,900	47.00	.....	4 39 30	
21,600	48.00	.227	39 52	
17,300	50.00	.250	40 32	
19,200	52.00	.270	41 09	
19,700	54.00	.278	41 45	
17,600	56.00	.270	42 22	
11,200	58.00	.333	43 02	
14,800	60.00	.294	43 36	
8,600	62.00	.263	44 14	
7,100	64 00	.238	44 56	
6,300	66.00	.313	45 28	
9,300	68.00	.278	46 04	
10,600	69.00	.313	46 20	
10,600	70.00	.250	46 40	
				New stroke of piston.
.....	.....	.....	4 51 20	Test resumed.
12,200	.....	.....	.....	Maximum momentary resistance.
4,100	71.00	.077	4 52 25	

Diameter of band after the test { Over lands in the copper, 3″.32.
Over grooves in the copper, 3″.21.

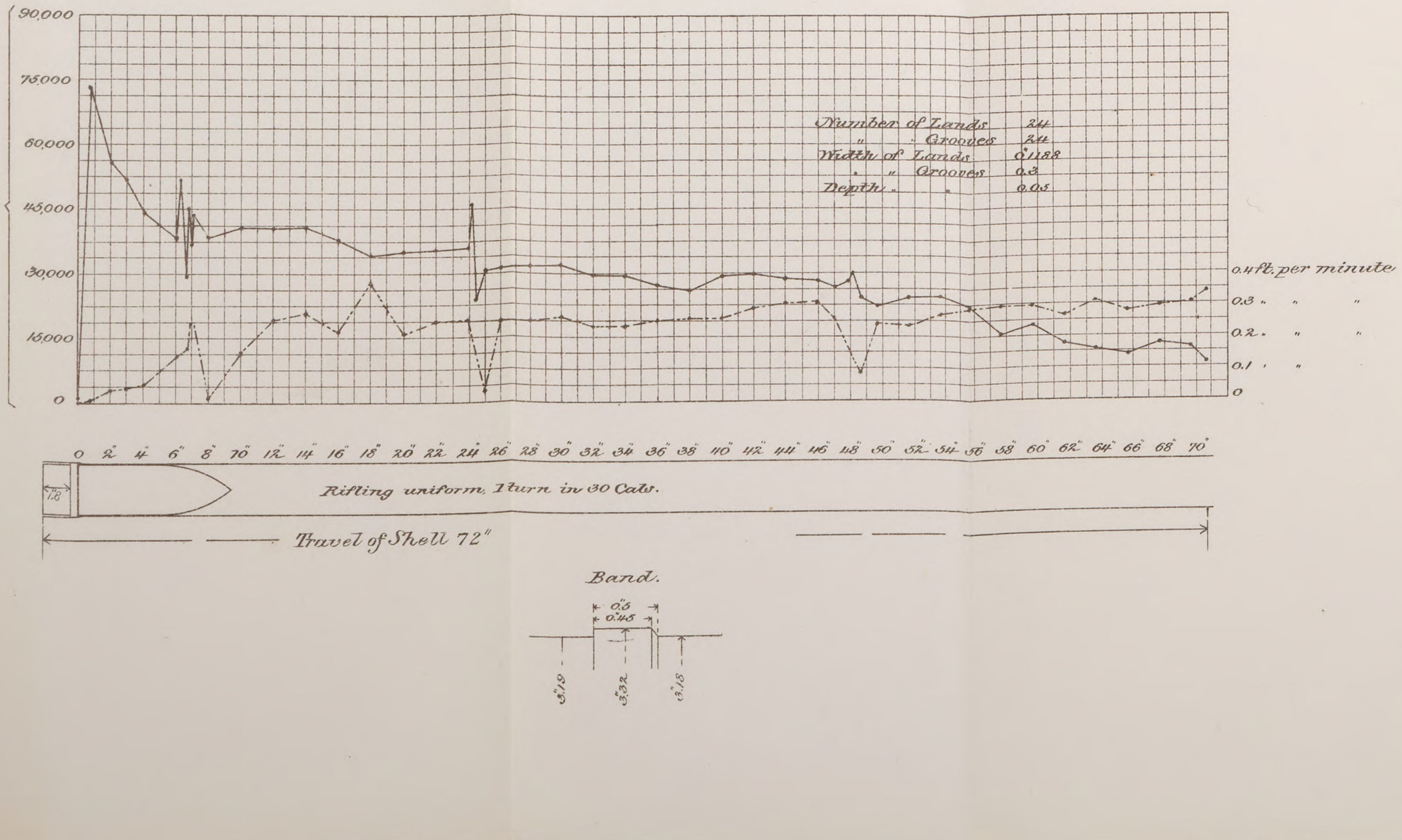
No. 8394.

3.2-inch B.L. Steel Field Rifle.

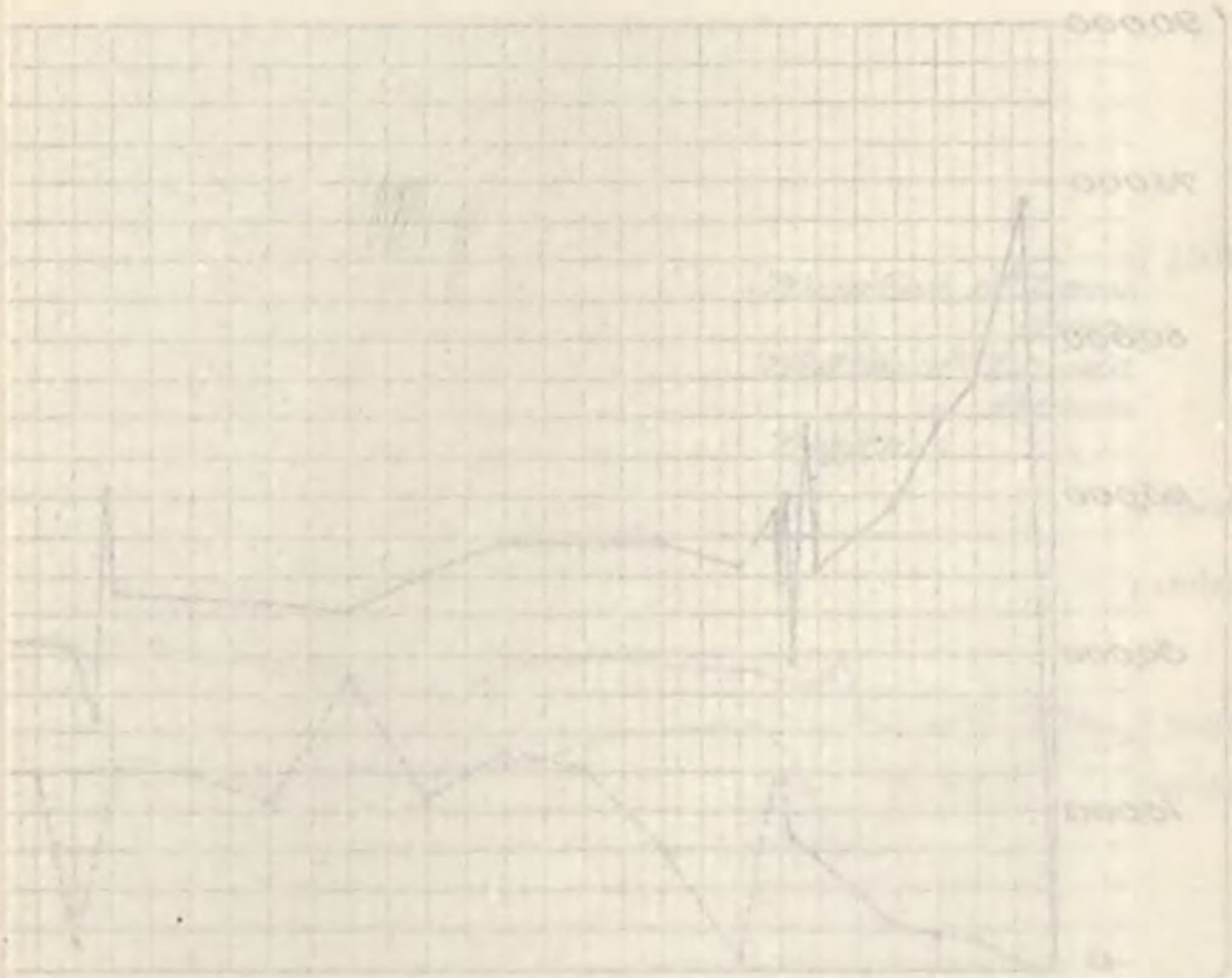
Model 1885.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore washed with soda water.



Band.



No. 8394.

Bore of gun washed with soda water and a new shell pushed through. Dimensions of band same as in test No. 8391.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	.....	9 05 10	
5,000	.02	.....	.....	
10,000	.06	.....	05 45	
15,000	.09	.....	.....	
20,000	.12	.....	06 45	
30,000	.18	.....	.....	
40,000	.26	.....	.....	
50,000	.35	.....	08 50	
55,000	.40	.....	.....	
60,000	.44	.....	10 35	
65,000	.48	.....	.....	
70,000	.58	.....	12 25	
72,900	.72	0.008	13 00	
67,000	.96	.....	13 45	
62,000	1.11	.....	14 12	
60,000	1.34	.....	14 32	
58,200	1.66	.....	15 18	
56,000	2.00	.037	15 52	
56,600	2.90	.....	.....	
52,000	3.00	.046	9 17 40	
44,000	4.00	.059	19 05	Increasing the speed appeared to lower the resistance.
38,500	6.00	.143	9 20 15	
				Load gradually increased.
51,000	.....	.....	.....	A throb occurred, the load falling to 29,500.
29,500	6.67	.....	.....	
				Load gradually brought up to 45,000.
45,000	.....	.....	.....	Speed now suddenly increased.
36,000	.....	.....	.....	Resistance while under rapid movement of the shell.
43,000	7.10	.....	9 31 30	
38,400	8.00	.014	32 00	
40,800	10.00	.154	33 05	
40,200	12.00	.256	33 44	
40,500	14.00	.278	34 20	
37,700	16.00	.222	35 05	
34,000	18.00	.370	35 32	
35,300	20.00	.217	36 18	
35,800	22.00	.250	36 58	
35,900	24.00	.256	37 37	
				New stroke of piston.
.....	.....	.....	10 10 45	Test resumed.
46,000	.....	.....	.....	Momentary resistance followed by sudden throb.
24,000	.....	.....	.....	Load after throb.
30,600	25.00	.030	10 13 30	
31,100	26.00	.250	13 50	
31,400	28.00	.250	14 30	
31,800	30.00	.263	15 08	
				Brief interruption in test.
29,300	32.00	.233	16 49	
29,200	34.00		17 32	
27,300	36.00	.250	18 12	
26,000	38.00	.256	18 51	
28,900	40.00	.256	19 30	
29,200	42.00	.286	20 05	
28,800	44.00	.303	20 38	
28,200	46.00	.313	21 10	
26,500	47.00	.263	21 29	
28,000	47.68	.....	.....	
				New stroke of piston.
.....	.....	.....	10 31 00	Test resumed.
30,000	.....	.....	31 20	Momentary resistance.
24,300	48.68	.086	31 58	
22,400	49.68	.238	32 19	
24,200	51.68	.233	10 33 02	
24,400	53.68	.270	33 39	
22,300	55.68	.286	34 14	
15,300	57.68	.294	34 48	
18,200	59.68	.294	35 22	
13,300	61.68	.263	36 00	
11,500	63.68	.313	36 32	
10,600	65.68	.278	37 08	
13,300	67.68	.294	37 42	
12,200	69.68	.303	38 15	
9,200	70.68	.333	38 30	

No. 8395.

Bore of gun well lubricated with heavy cylinder oil, and a new shell pushed through the gun.

Dimensions of band same as in previous tests.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
2,400	0.	0.	2 18 30	
5,000	.01	.....	.....	
10,000	.02	.....	19 20	
15,000	.06	.....	.....	
20,000	.11	.....	.....	
30,000	.19	.....	20 35	
40,000	.26	.....	.....	
50,000	.34	.....	22 20	
55,000	.48	.....	.....	
60,000	.41	.....	24 20	
65,000	.45	.....	.....	
70,000	.53	.....	25 50	
72,200	.61	.....	26 20	
72,500	.68	.006	26 45	
70,000	.80	.....	27 15	
67,000	.92	.....	27 35	
64,600	1.00	.023	27 55	
62,000	1.20	.....	2 28 30	
60,000	1.42	.....	29 10	
58,000	1.69	.....	30 00	
52,400	2.00	.032	30 30	
38,500	4.00	.161	31 32	
38,900	6.00	.208	32 20	
40,200	8.00	.222	33 05	
41,500	10.00	.333	33 35	
40,500	12.00	.200	34 25	
38,900	14.00	.233	35 08	
36,400	16.00	.270	35 45	
34,100	18.00	.233	36 28	
35,500	20.00	.238	37 10	
34,900	22.00	.263	37 48	
36,100	23.00	.250	38 08	
36,200	24.00	.250	38 28	
				New stroke of piston.
.....	.....	.....	2 48 00	Test resumed.
41,700	.....	.....	48 40	Momentary resistance.
44,900	.....	.....	.....	Throb.
33,100	25.00	.040	2 50 05	
31,800	26.00	.250	50 25	
31,400	28.00	.333	50 55	
31,700	30.00	.286	51 30	
28,900	32.00	.333	52 00	
27,800	34.00	.313	52 32	
26,300	36.00	.313	53 04	
25,100	38.00	.333	53 34	
27,900	40.00	.294	2 54 08	
27,800	42.00	.323	54 39	
26,900	44.00	.303	55 12	
26,900	46.00	.313	55 44	
25,000	48.00	.294	56 18	
				New stroke of piston.
			3 04 30	Test resumed.
28,700	.....	.....	05 15	
25,100	49.00	.048	06 15	
23,200	50.00	.217	06 38	
24,100	52.00	.294	07 12	
23,500	54.00	.370	07 39	
22,200	56.00	.278	08 15	
16,900	58.00	.333	08 45	
19,200	60.00	.303	09 18	
12,000	62.00	.313	09 50	
11,200	64.00	.357	10 18	
10,200	66.00	.400	10 43	
14,300	.....	.....	.....	
12,200	68.00	.345	11 12	
12,600	70.00	.476	11 33	
5,000	71.00	.....	.....	

No. 8395.

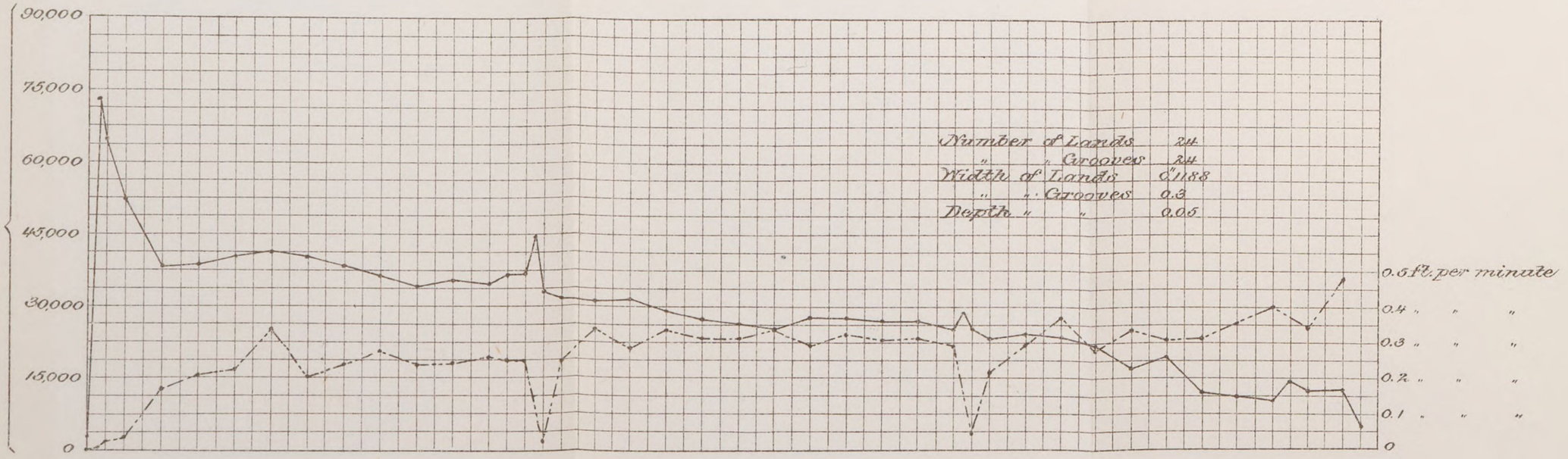
3.2-inch B.L. Steel Field Rifle.

Model 1885.

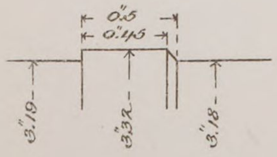
Diagram showing curves of resistance,

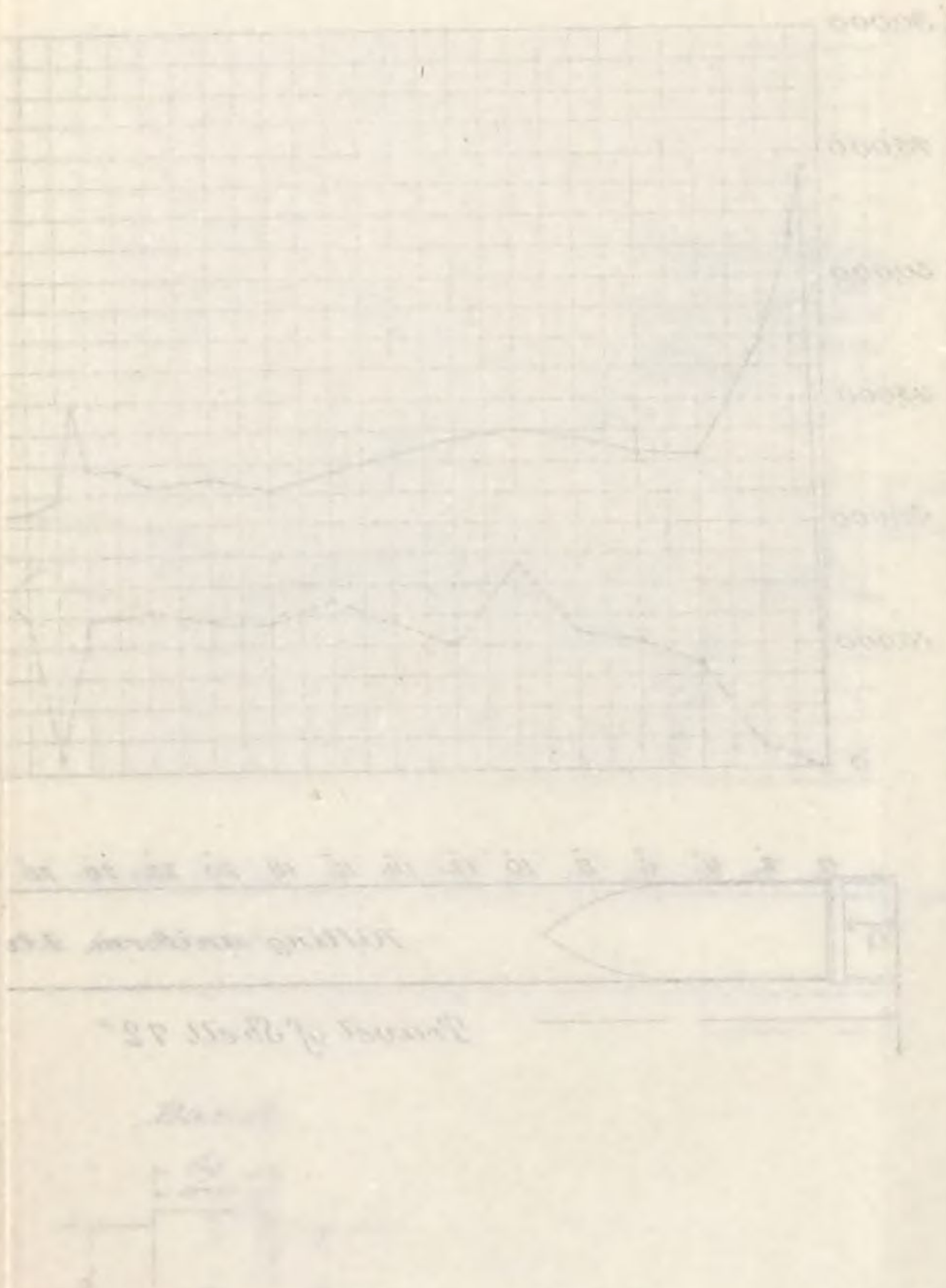
and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band.





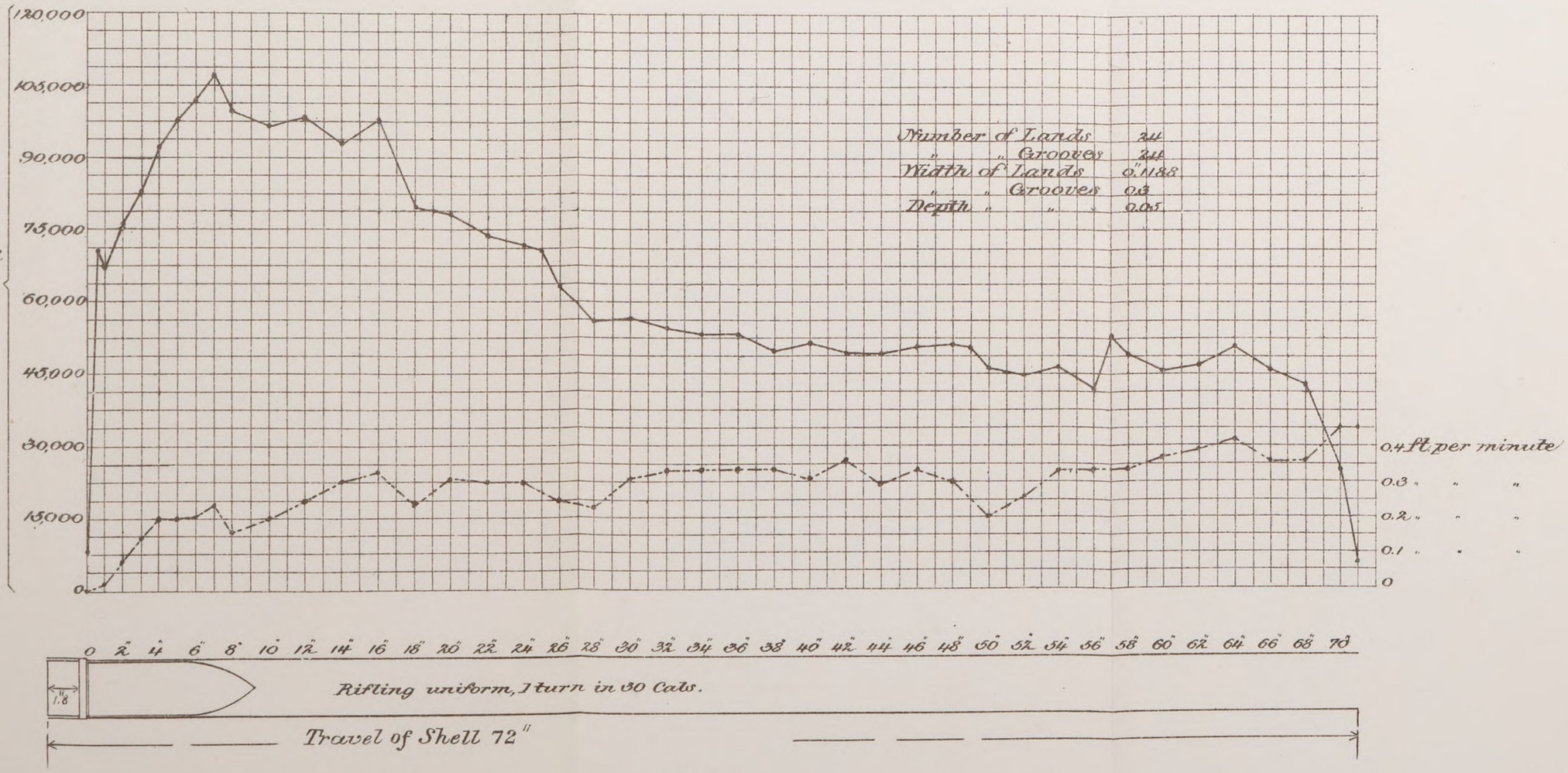
No. 8396.

3.2-inch B.L. Steel Field Rifle

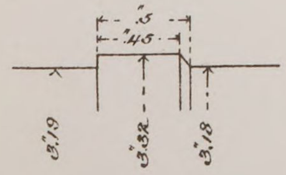
Model 1885.

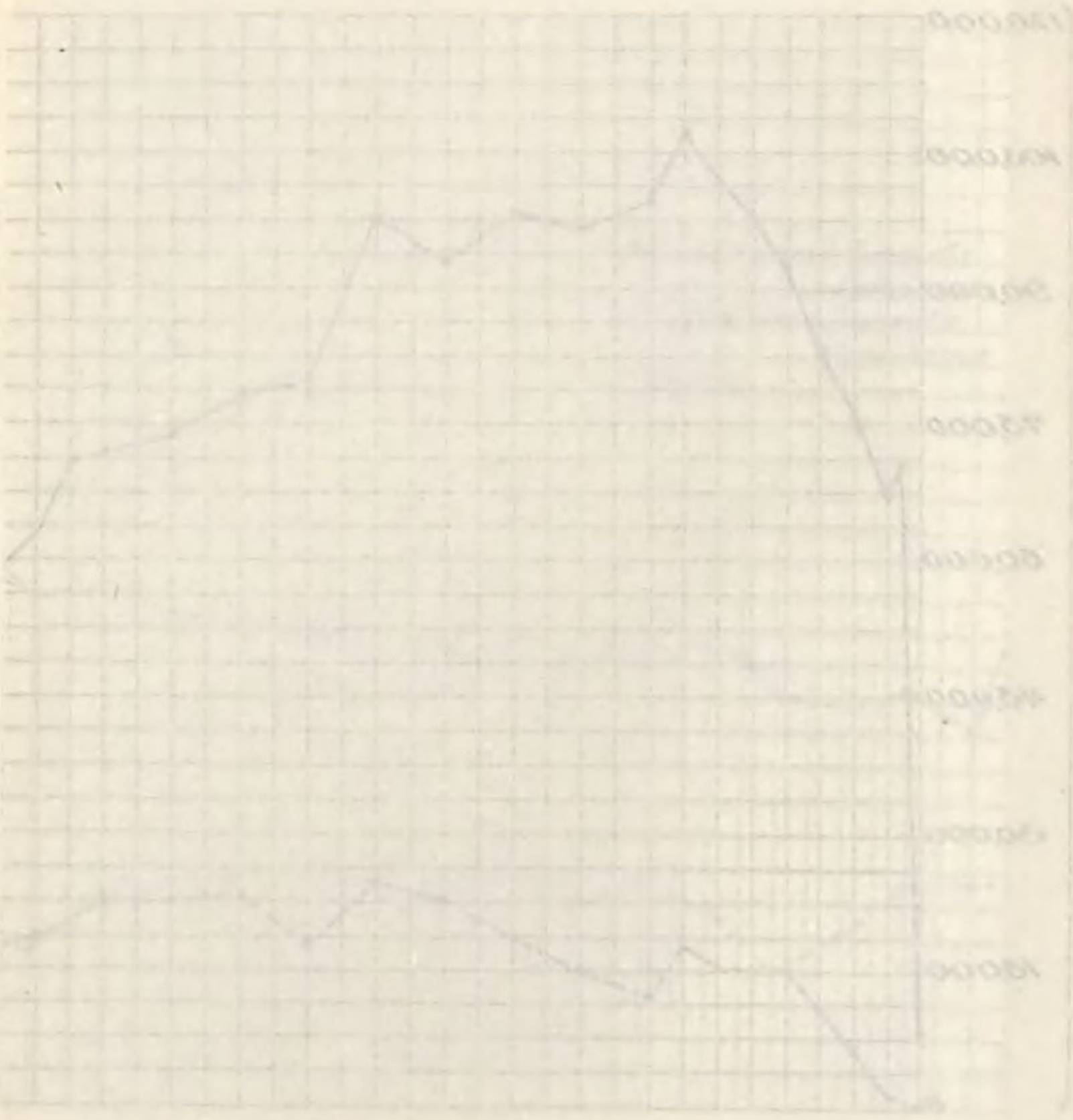
Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

Bore of gun fouled, by firing three blank cartridges 10 minutes before test began.



Band.





No. 8396.

Bore of gun fouled by means of three rounds with blank cartridges of 1 pound of powder each, fired immediately before testing.

New shell pushed through the gun having the same dimensions of band as in the previous tests.

Test began about ten minutes after firing the third round.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
7,800	0.	0.	4 04 50	
15,000	.03	.....	.....	
20,000	.07	.....	.....	
30,000	.13	.....	05 55	
40,000	.22	.....	.....	
50,000	.30	.....	.....	
60,000	.37	.....	07 55	
70,000	.53	.....	.....	
70,600	.62	.....	.....	
68,000	.77	.....	08 35	
66,700	1.00	.019	09 10	
76,100	2.00	.083	10 10	
82,700	3.00	.143	10 45	
92,300	4.00	.200	11 10	
97,700	5.00	.200	4 11 35	
101,700	6.00	.217	11 58	
107,100	7.00	.294	12 15	
99,800	8.00	.167	12 45	
96,300	10.00	.200	13 35	
98,200	12.00	.250	14 15	
92,800	14.00	.303	14 48	
97,600	16.00	.333	15 18	
79,600	18.00	.238	16 00	
78,200	20.00	.313	16 32	
73,800	22.00	.303	17 05	
72,200	24.00	.303	17 38	
				New stroke of piston.
.....	.....	.....	4 24 59	Test resumed.
73,200	.....	.....	.....	
71,000	25.00	.052	26 35	
63,500	26.00	.250	26 55	
56,200	28.00	.233	27 38	
56,400	30.00	.313	28 10	
54,200	32.00	.333	28 40	
53,400	34.00	.333	29 10	
53,500	36.00	.333	29 40	
49,900	38.00	.333	30 10	
51,900	40.00	.313	30 42	
49,400	42.00	.357	31 10	
48,900	44.00	.286	31 45	
50,500	46.00	.333	32 15	
51,100	48.00	.303	4 32 48	
				New stroke of piston.
.....	.....	.....	4 40 40	Test resumed.
49,000	.....	.....	.....	
50,600	49.00	.083	41 40	
46,400	50.00	.200	42 05	
44,900	52.00	.263	42 43	
46,800	54.00	.333	43 13	
42,000	56.00	.333	43 43	
53,000	.....	.....	.....	
49,000	58.00	.333	44 15	
45,900	60.00	.370	44 32	
47,000	62.00	.385	45 08	
50,200	64.00	.417	45 32	
46,200	66.00	.357	46 00	
43,200	68.00	.357	46 28	
25,100	70.00	.455	4 46 50	
5,000	71.00	.....	.....	

The residue of the powder accumulated in front of the band on the shell, and when the latter reached the muzzle of the gun the residue filled the space between the shell and the gun, covering about $1\frac{1}{8}''$ in length along the shell.

No. 8399.

A new shell with band of same dimensions as in previous tests pushed through the gun by means of follower mounted on the anti-friction nut.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	10 27 20	
10,000	.03	----------	----------	
20,000	.08	----------	----------	
30,000	.14	----------	28 05	
40,000	.22	----------	----------	
50,000	.32	----------	----------	
55,000	.39	----------	----------	
56,800	.45	.016	29 40	
55,000	.53	----------	30 04	
45,000	.78	----------	30 32	
38,400	1.00	.037	30 55	
33,000	2.00	.111	31 40	
27,800	4.00	.192	32 32	
29,000	6.00	.263	33 10	
25,900	8.00	.263	33 48	
25,600	10.00	.333	34 18	
24,200	12.00	.345	34 47	
21,500	14.00	.323	10 35 18	
21,100	16.00	.370	35 45	
19,800	18.00	.333	36 15	
19,100	20.00	.417	36 39	
18,600	22.00	.345	37 08	
18,200	23.00	.500	37 18	
18,100	23.58	.242	37 30	
				New stroke of piston.
----------	----------	----------	11 00 20	Test resumed.
23,400	----------	----------	----------	
19,100	24.58	.051	01 58	
19,200	25.58	.250	02 18	
18,200	27.58	.313	02 50	
17,900	29.58	.333	03 20	
16,100	31.58	.400	03 45	
16,400	33.58	.370	04 12	
16,500	35.58	.357	04 40	
14,600	37.58	.357	05 08	
15,000	39.58	.357	05 36	
15,400	41.58	.417	06 00	
15,500	43.58	.357	06 28	
16,100	45.58	.385	06 54	
16,100	46.76	.369	07 10	
				New stroke of piston.
----------	----------	----------	11 25 00	Test resumed.
19,200	----------	----------	----------	
15,300	47.76	.071	26 10	
16,400	48.76	.200	11 26 35	
17,300	50.76	.233	27 18	
17,100	52.76	.333	27 48	
16,500	54.76	.370	28 15	
15,400	56.76	.435	28 38	
14,500	58.76	.313	29 10	
				Test interrupted.
13,500	60.76	.250	29 50	
12,000	62.76	.357	30 18	Test interrupted.
----------	----------	----------	11 35 00	Test resumed.
11,700	64.76	.256	35 39	
12,200	66.76	.323	36 10	
11,500	68.76	.357	36 38	
11,400	70.26	.278	37 05	
				New stroke of piston.
----------	----------	----------	11 45 15	Test resumed.
11,800	70.28	----------		

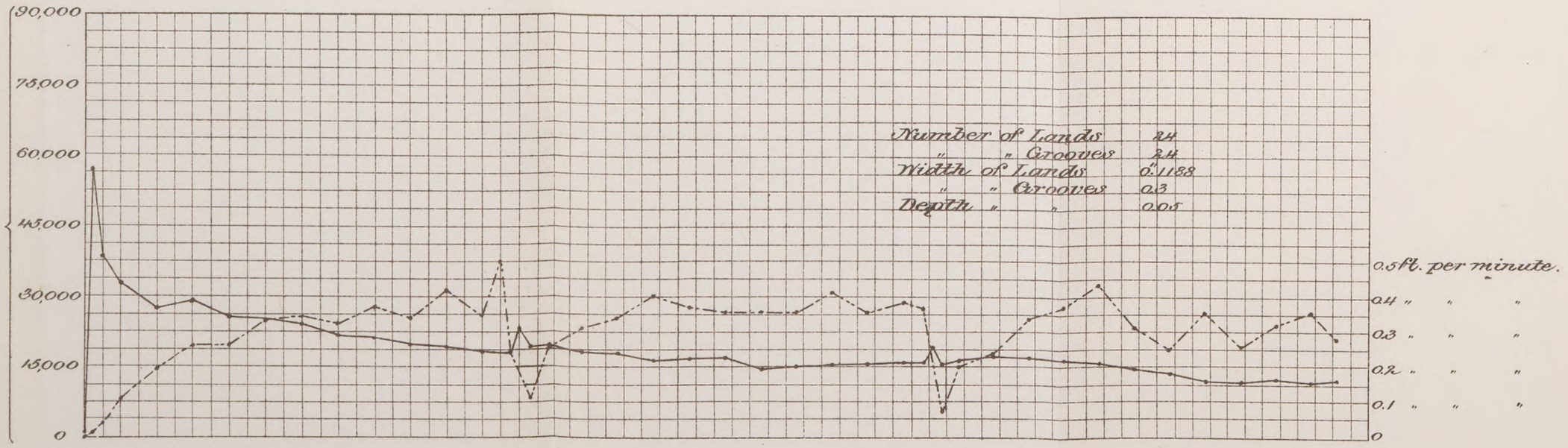
No. 8399.

3.2-inch B.L. Steel Field Rifle

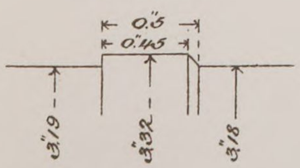
Model 1885.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated.



Band.



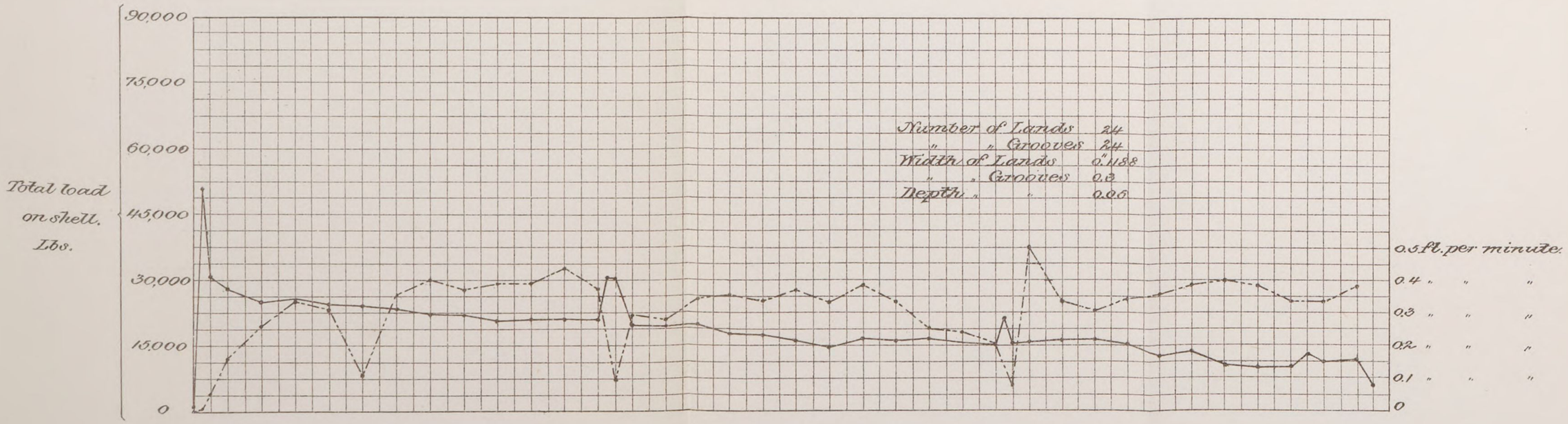
No. 8400.

3.2-inch B.L. Steel Field Rifle.

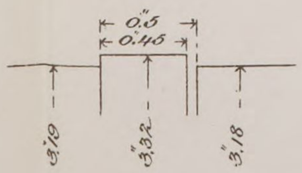
Model 1885.

Diagram showing curves of resistance and velocity, of banded shell when forced through the bore.

Bore lubricated



Band



No. 8400.

Condition of test same as No. 8399 excepting the follower is gripped in the holder jaws, the antifriction nut not being used.

Bore of gun lubricated with heavy cylinder oil.

Shell pushed through the gun. Dimensions of band same as in previous tests.

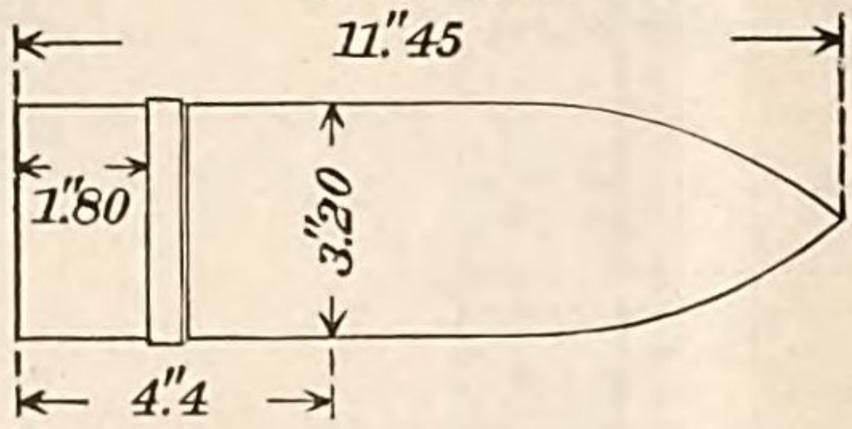
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	1 39 10	
10,000	.04	----------	----------	
20,000	.13	----------	----------	
30,000	.23	----------	----------	
40,000	.35	----------	41 00	
50,000	.48	----------	----------	
51,000	.54	.014	42 20	
36,000	.90	----------	----------	
31,000	1.00	.057	43 00	
28,200	2.00	.167	43 30	
25,000	4.00	.263	44 08	
26,100	6.00	.333	44 38	
24,600	8.00	.313	45 10	
				Test interrupted.
24,400	10.00	.111	1 46 40	
23,600	12.00	.357	47 08	
22,300	14.00	.400	47 33	
22,100	16.00	.370	48 00	
20.600	18.00	.385	48 26	
21,000	20.00	.385	48 52	
21,100	22.00	.435	49 15	
21,000	24.00	.370	49 42	
				New stroke of piston.
----------	----------	----------	2 07 30	Test resumed.
30,400	----------	----------	----------	
30,300	25.00	.091	08 25	
19,500	26.00	.294	08 42	
19,400	28.00	.278	09 18	
19,700	30.00	.345	09 47	
17,600	32.00	.357	10 15	
17,300	34.00	.333	10 45	
16,100	36.00	.370	11 12	
14,800	38.00	.333	11 42	
16,500	40.00	.385	12 08	
16,100	42.00	.333	12 38	
16,500	44.00	.250	13 18	
15,700	46.00	.238	14 00	
				Test interrupted.
15,000	48.00	.208	14 48	
				New stroke of piston.
----------	----------	----------	2 30 00	Test resumed.
21,000	----------	----------	----------	
15,200	49.00	.077	2 31 05	
15,800	50.00	.500	31 15	
16,200	52.00	.333	31 45	
16,300	54.00	.303	32 18	
15,300	56.00	.345	32 47	
12,700	58.00	.357	33 15	
13,700	60.00	.385	33 41	
10,800	62.00	.400	34 06	
10,100	64.00	.385	34 32	
10,200	66.00	.333	35 02	
13,400	----------	----------	----------	
11,200	68.00	.333	35 32	
11,400	70.00	.385	35 58	
6,000	71.00	----------	----------	

3.2-INCH DRIGGS-SCHROEDER B. L. STEEL FIELD RIFLE.

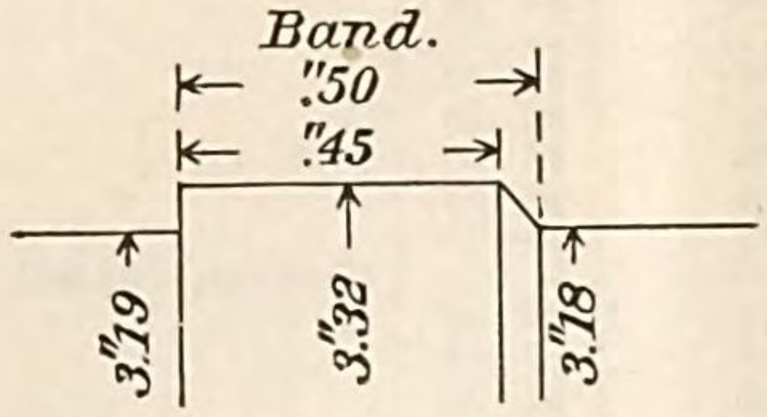
No. 8391.

Gun branded at muzzle { "Watervliet Arsenal. 815 lbs. No. 1. D. A. H. 1892."

3.2 shell.



Band.



Shell pushed through the gun. The bore of the gun was in a thoroughly greased condition when this shell was forced through.

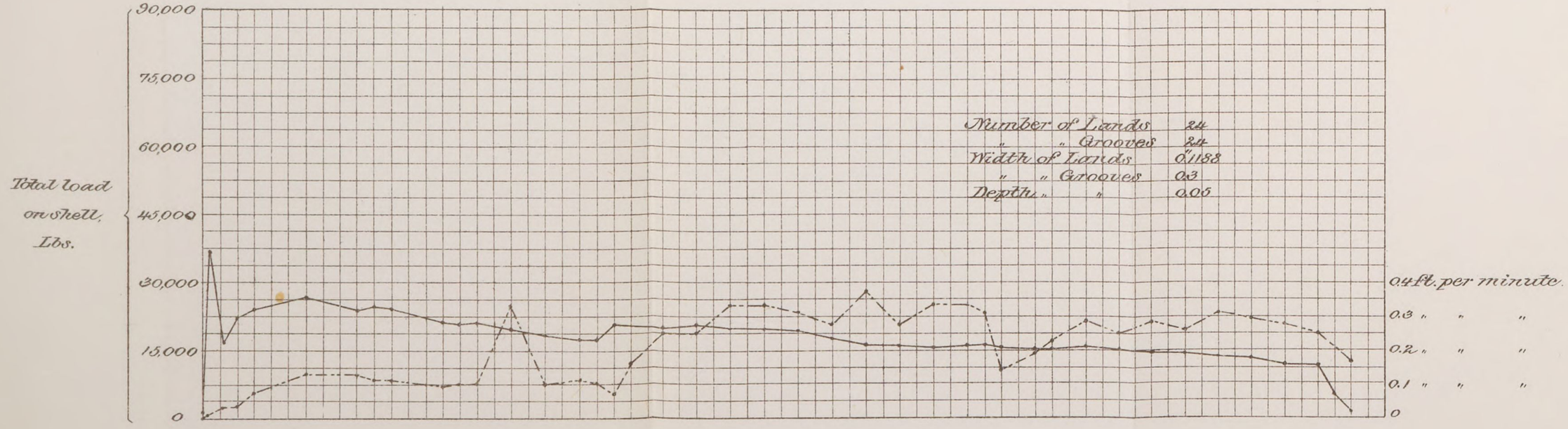
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	.....	9 03 20	Initial load.
20,000	.04	.....	04 00	
25,000	.09	.....	04 20	
25,500	.13	.....	05 10	
30,000	.19	.....	05 40	
37,000	.37	0.010	06 20	
20,000	.60	.....	06 40	
17,500	.85	.....	07 30	
16,500	1.14	.030	08 30	
18,200	1.30	.....	09 25	
20,000	1.54	.....	10 05	
22,400	2.00	.033	10 40	
24,000	3.00	.077	11 45	
25,400	4.00	.....	9 12 30	
26,200	5.00	.....	13 10	
26,600	6.00	.130	13 40	
25,200	7.00	.....	14 20	
24,200	8.00	.....	15 00	
23,850	9.00	.130	15 35	
24,600	10.00	.111	16 20	
24,100	11.00	.111	17 05	
22,300	12.00	.....	17 50	
21,900	13.00	.....	18 35	
21,100	14.00	.097	19 40	
20,400	15.00	.100	20 30	
21,000	16.00	.100	21 20	
19,400	18.00	.333	22 50	
18,300	20.00	.100	24 30	
17,500	22.00	.110	26 00	
17,500	23.00	.100	26 50	
				New stroke of piston.
	23.00	.....	9 40 00	
20,800	24.00	.071	41 10	
20,100	25.00	.167	41 40	
19,600	27.00	.250	42 20	
20,500	29.00	.250	43 00	
20,100	31.00	.333	43 30	

No. 8391.

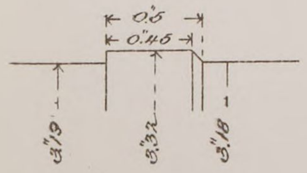
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

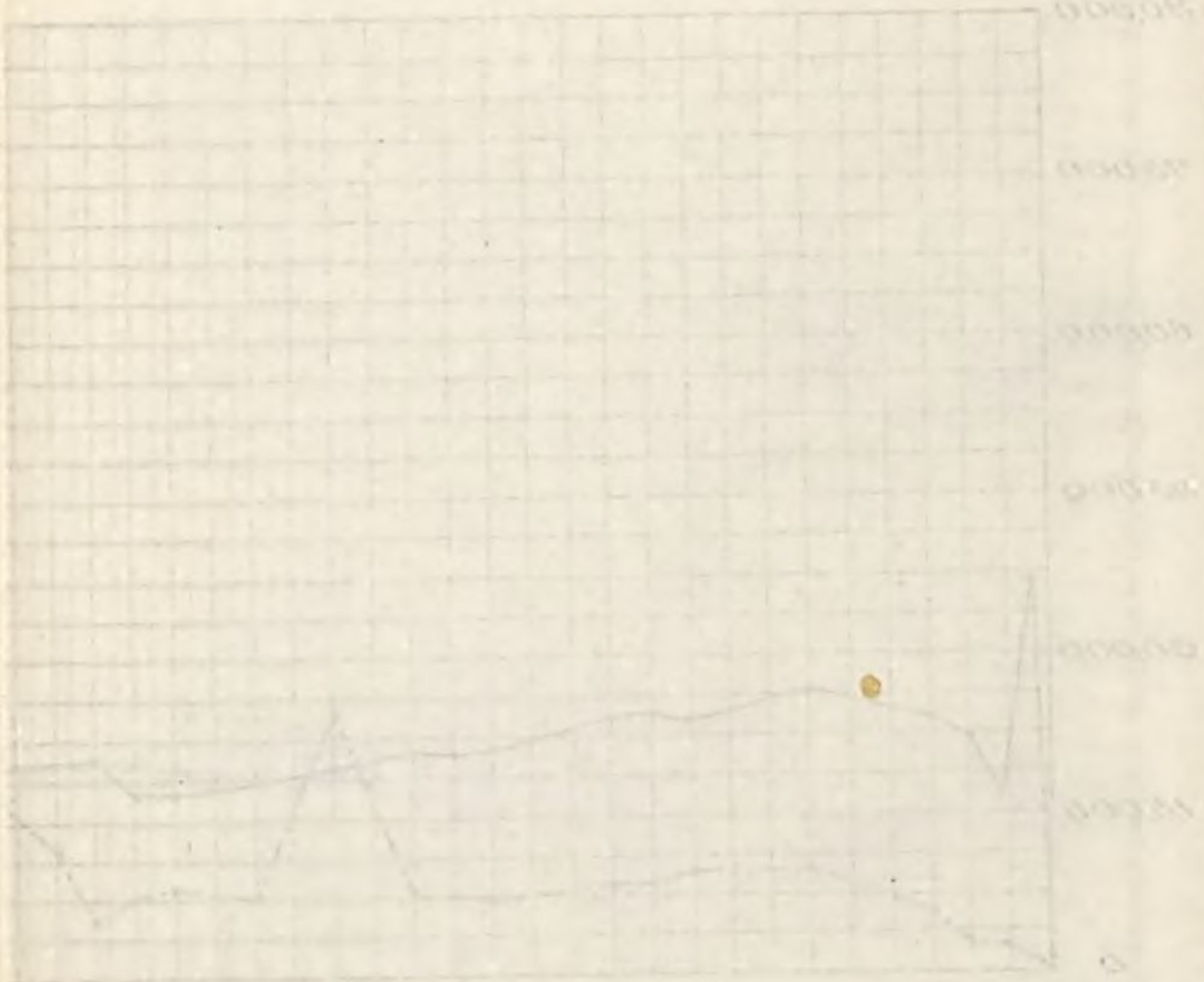
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band





No. 8391—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
20,000	33.00	.333	44 00	
19,100	35.00	.313	44 32	
17,900	37.00	.278	45 08	
16,200	39.00	.370	9 45 35	
16,100	41.00	.270	46 12	
15,700	43.00	.333	46 42	
16,000	45.00	.333	47 12	
16,300	46.00	.313	47 28	
				New stroke of piston.
.....	46.00	.....	9 58 00	
15,680	47.00	.143	58 35	
15,400	49.00	.189	59 28	
15,300	50.00	.227	59 50	
15,800	52.00	.286	10 00 25	
15,100	54.00	.250	01 05	
14,400	56.00	.286	01 40	
14,300	58.00	.263	02 18	
13,800	60.00	.313	02 50	
13,500	62.00	.294	03 24	
12,000	64.00	.278	04 00	
12,000	66.00	.250	04 40	
5,000	67.00	.....	.....	
1,000	68.00	.167	10 05 40	

Maximum diameter of band after the test, 3″.32.

No. 8392.

Bore of gun washed with soda water and a new shell pushed through. Dimensions of band same as in test No. 8391.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	.....	11 33 00	Initial load.
10,000	.05	.....	33 20	
20,000	.11	.....	34 10	
23,000	.14	.....	35 20	
28,000	.22	.....	36 20	
35,000	.32	.....	37 20	
40,000	.38	.....	38 25	
41,300	.43	0.006	39 08	
37,500	.49	.....	39 55	
34,000	.55	.....	40 18	
28,000	.63	.....	40 55	
25,000	.76	.....	41 30	
23,800	1.00	.018	41 50	
28,500	2.00	.125	42 30	
32,600	3.00	.143	43 05	
35,400	4.00	.185	43 32	
37,400	5.00	.132	44 10	
38,200	6.00	.167	44 40	
36,200	8.00	.161	45 42	
31,600	10.00	.173	46 40	
30,100	12.00	.173	11 47 38	
26,900	14.00	.125	48 58	
25,000	16.00	.250	49 38	
23,600	18.00	.250	50 18	
23,200	20.00	.238	51 00	
23,500	22.00	.294	51 34	
23,000	23.00	.238	51 55	
				New stroke of piston.
.....	.....	.....	1 06 00	
27,000	.....	.....	.....	Momentary maximum resistance.
22,500	23.19	.024	06 40	
25,000	24.00	.101	07 20	
25,400	25.00	.227	07 42	
24,500	27.00	.263	08 20	
23,800	29.00	.333	08 50	
25,700	31.00	.357	09 18	
26,300	33.00	.313	09 50	
28,600	35.00	.345	10 19	
27,500	37.00	.313	10 51	
27,300	39.00	.333	11 21	
27,300	41.00	.323	11 52	
26,600	43.00	.333	12 22	
28,600	45.00	.333	12 52	
27,100	46.00	.313	13 08	
				New stroke of piston.
.....	.....	.....	1 20 20	
31,000	46.05	.007	1 20 55	Momentary maximum resistance.
26,200	47.00	.158	21 25	
26,700	48.00	.294	21 42	
25,300	50.00	.313	22 14	
24,900	52.00	.385	22 40	
24,000	54.00	.357	23 08	
21,500	56.00	.417	23 32	
20,600	58.00	.385	23 58	
20,000	60.00	.417	24 22	
19,600	62.00	.385	24 48	
18,500	64.00	.370	25 15	
15,200	66.00	.400	25 40	
4,000	68.00	.333	1 26 10	

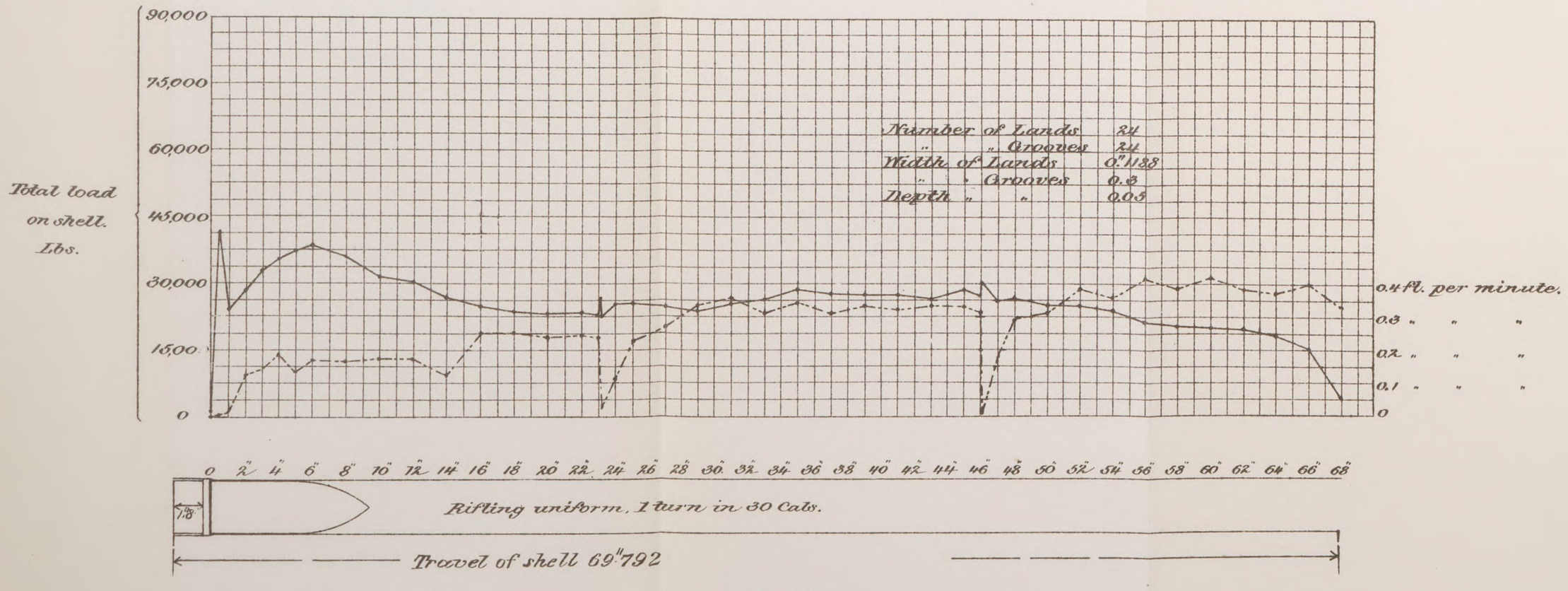
Maximum diameter of band at bottom of grooves after the test, 3″.22.

No. 8392.

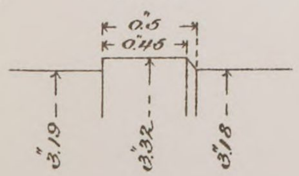
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

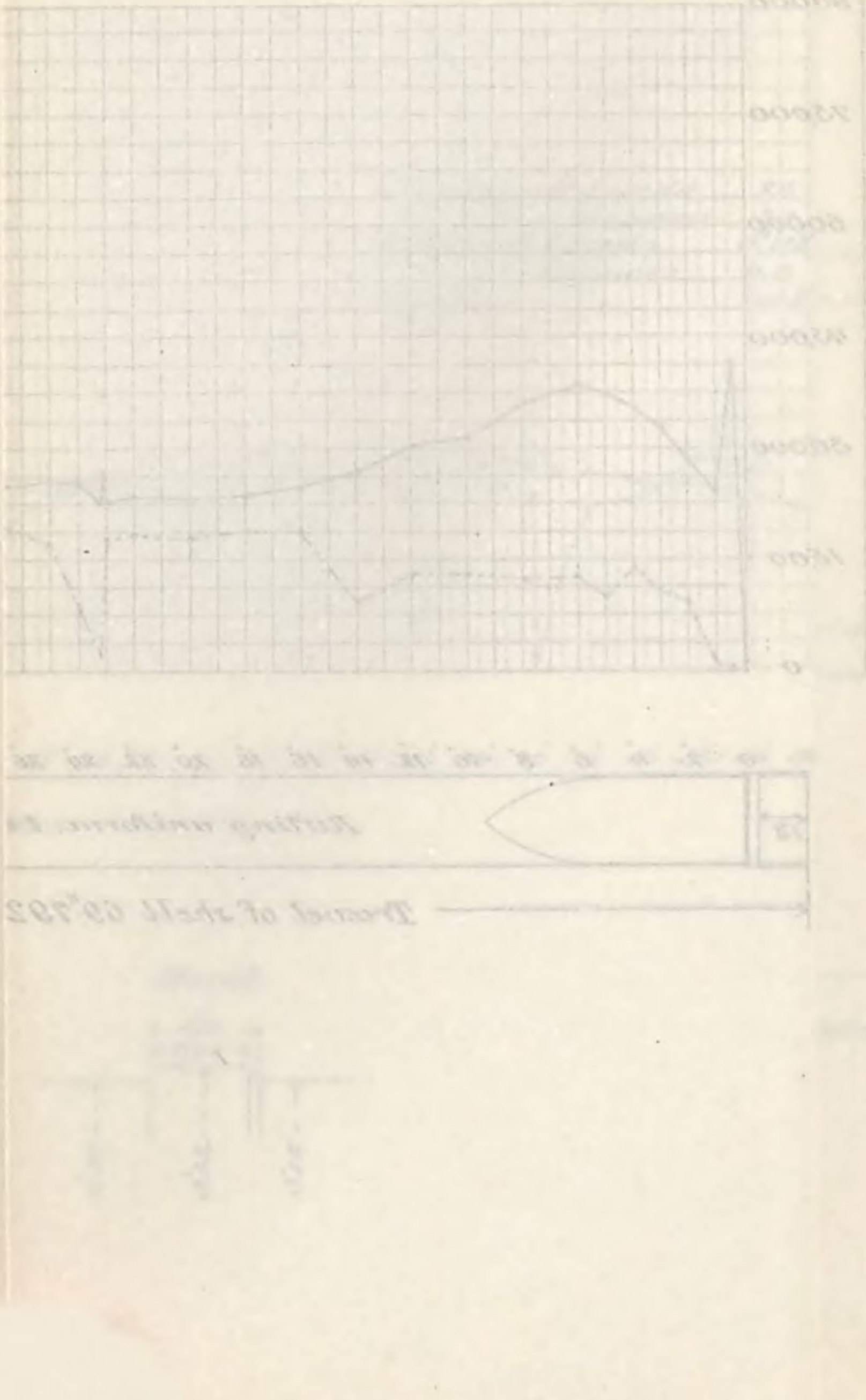
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore washed with soda water.



Band



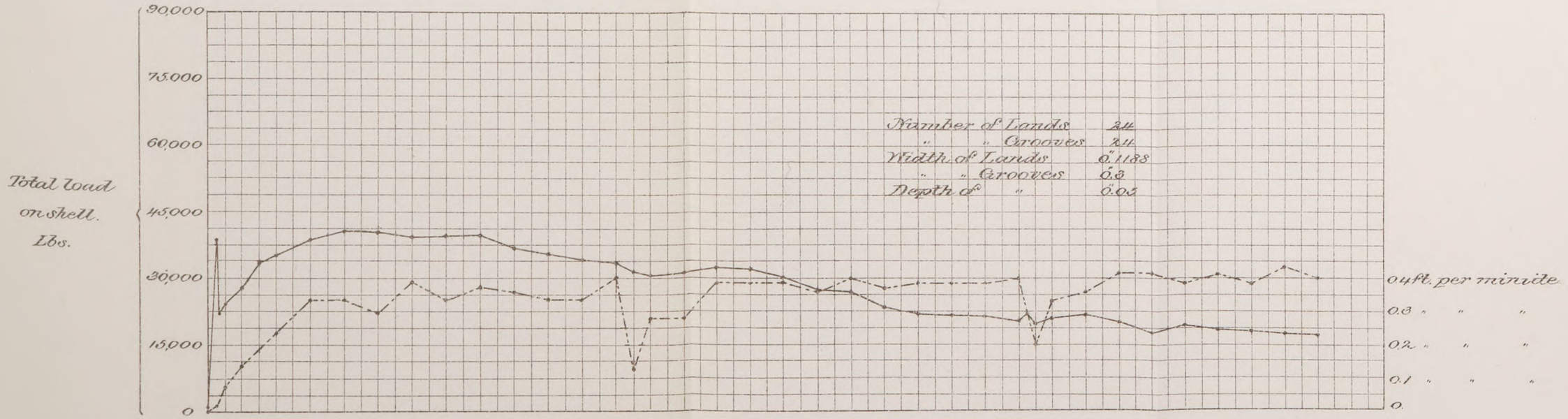


No. 8402.

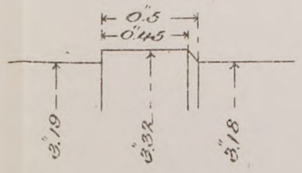
3 2-inch Driggs-Schroeder B.L. Steel Field Rifle.

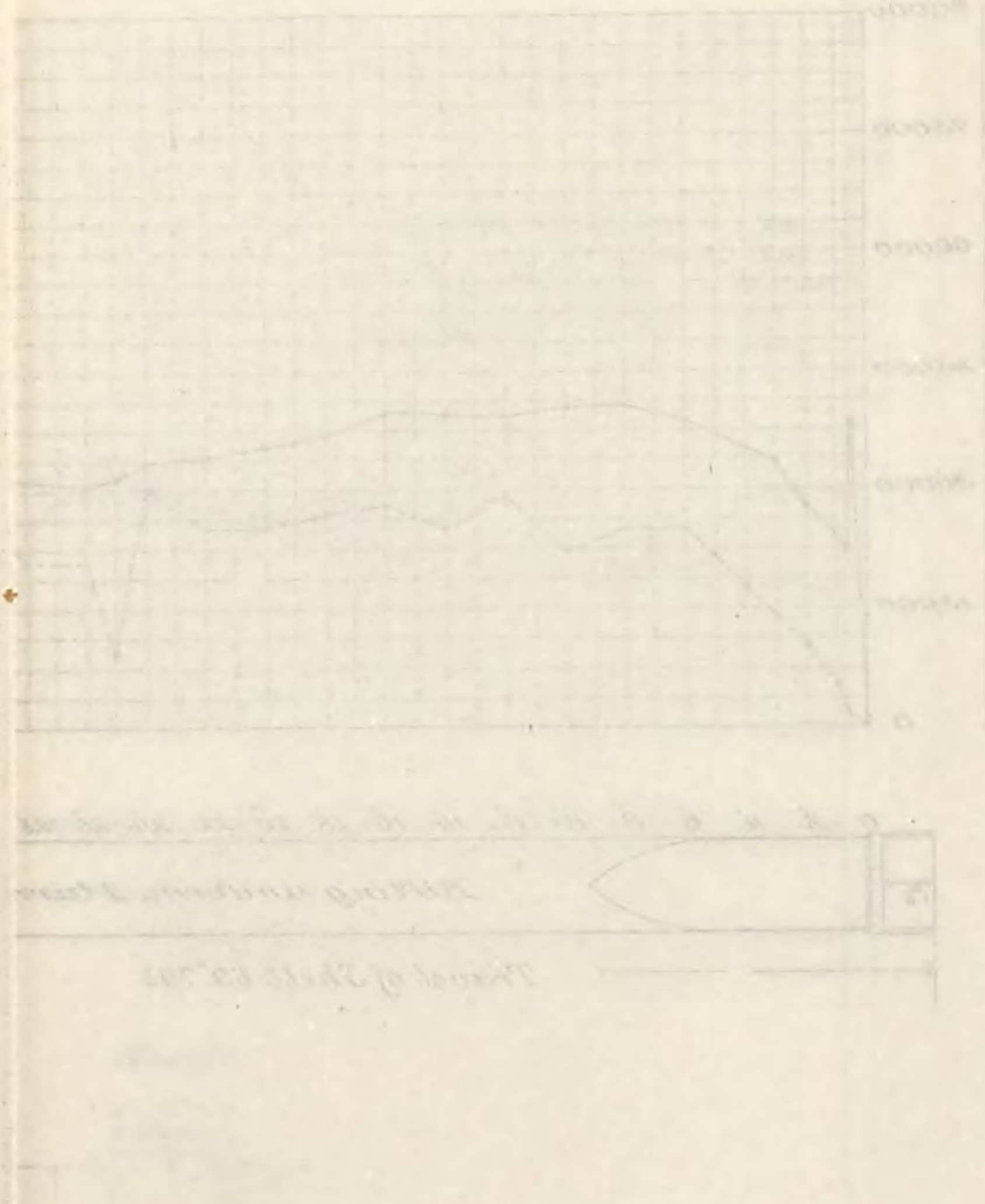
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band





No. 8402.

Bore lubricated with heavy cylinder oil.
Follower gripped in the holder jaws.
Dimensions of band same as in previous tests.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	3 45 10	Initial load.
10,000	.03	----------	----------	
20,000	.11	----------	----------	
30,000	.24	----------	3 46 40	
38,600	.45	.020	3 47 12	
22,000	.65	.025	47 32	
23,800	1.00	.076	47 55	
27,600	2.00	.135	48 32	
33,600	3.00	----------	----------	
34,800	4.00	.233	49 15	
38,600	6.00	.333	49 45	
40,600	8.00	.333	50 15	
40,300	10.00	.294	50 49	
39,300	12.00	.385	51 15	
39,500	14.00	.333	51 45	
39,600	16.00	.370	52 12	
36,700	18.00	.357	52 40	
35,100	20.00	.333	3 53 10	
33,800	22.00	.333	53 40	
33,100	24.00	.400	54 05	
----------	----------	----------		New stroke of piston.
----------	----------	----------	4 11 30	Test resumed.
33,000	----------	----------	----------	
31,300	25.00	.125	4 12 10	
30,200	26.00	.278	12 28	
30,800	28.00	.278	13 04	
32,100	30.00	.385	13 30	
31,800	32.00	.385	13 56	
30,200	34.00	.385	14 22	
27,000	36.00	.357	14 50	
26,600	38.00	.400	15 15	
23,300	40.00	.370	15 42	
21,800	42.00	.385	16 08	
21,500	44.00	.385	16 34	
21,200	46.00	.385	17 00	
20,200	48.00	.400	17 25	
----------	----------	----------		New stroke of piston.
----------	----------	----------	4 28 10	Test resumed.
22,000	----------	----------	----------	
19,500	49.00	.200	4 28 35	
20,700	50.00	.333	28 50	
21,700	52.00	.357	29 18	
19,900	54.00	.417	29 42	
17,600	56.00	.417	30 06	
19,400	58.00	.385	4 30 32	
18,500	60.00	.417	30 56	
18,200	62.00	.385	31 22	
17,500	64.00	.435	31 45	
17,200	66.00	.400	32 10	

No. 8403.

Bore lubricated with heavy cylinder oil.
Follower attached to antifriction nut, and shell pushed through the gun.
Dimensions of band same as in previous tests.

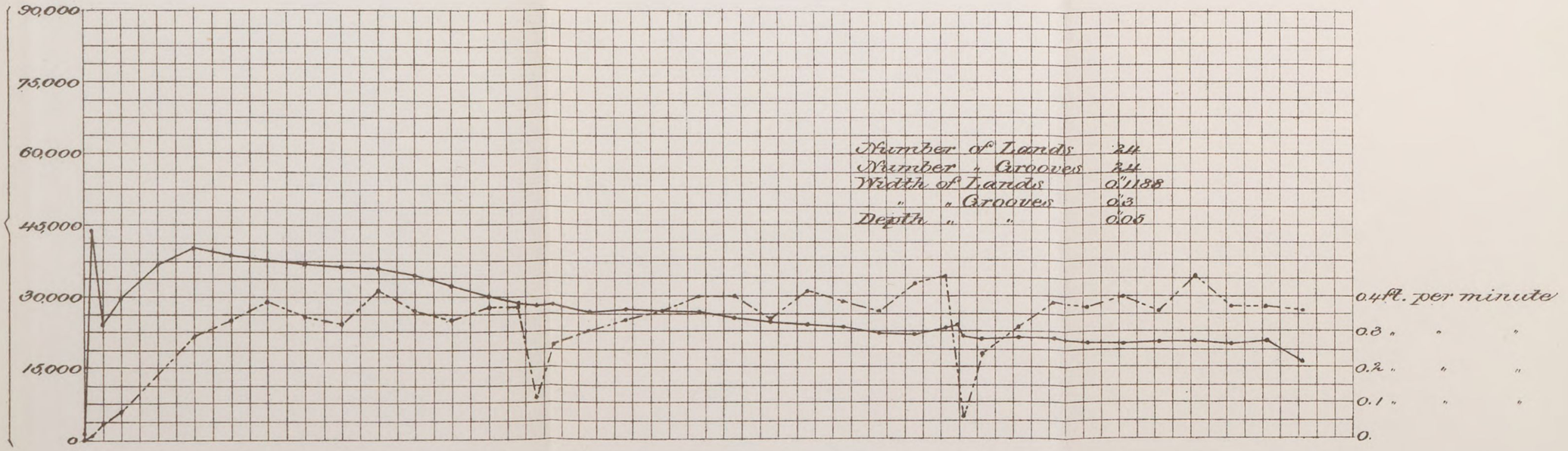
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	9 55 00	Initial load.
10,000	.03	----------	----------	
20,000	.06	----------	----------	
30,000	.12	.009	56 05	
40,000	.24	----------	----------	
44,200	.37	.013	57 40	
30,000	.60	----------	----------	
24,000	.79	----------	----------	
23,900	1.00	.042	58 55	
29,900	2.00	.077	10 00 00	Interruption.
37,100	4.00	----------	10 01 55	
40,400	6.00	.286	02 30	
38,600	8.00	.333	03 00	
37,600	10.00	.385	03 26	
37,100	12.00	.345	03 55	
36,200	14.00	.323	04 26	
36,000	16.00	.417	04 50	
34,100	18.00	.357	10 05 18	
32,200	20.00	.333	05 48	
30,000	22.00	.370	06 15	
28,500	23.61	.370	06 42	
				New stroke of piston.
----------	----------	----------	10 21 30	Test resumed.
27,800	----------	----------	----------	
27,100	24.61	.104	10 22 18	
27,300	25.61	.263	22 37	
26,400	27.61	.303	23 10	
27,100	29.61	.333	23 40	
26,700	31.61	.357	24 08	
26,500	33.61	400	24 33	
24,900	35.61	.400	24 58	
24,400	37.61	.333	25 28	
23,600	39.61	.417	25 52	
23,400	41.61	.385	26 18	
22,300	43.61	.357	26 46	
22,200	45.61	.435	27 09	
22,900	47.23	.454	27 31	
				New stroke of piston.
----------	----------	----------	10 40 00	Test resumed.
23,500	----------	----------	----------	
21,300	48.23	.063	10 41 19	
20,500	49.23	.238	41 40	
21,100	51.23	.312	42 12	
21,000	53.23	.385	42 38	
20,100	55.23	.370	10 43 05	
20,000	57.23	.400	43 30	
20,200	59.23	.357	43 58	
20,200	61.23	.454	44 20	
20,100	63.23	.370	44 47	
20,500	65.23	.370	45 14	
16,000	67.23	.357	45 42	

No. 8403.

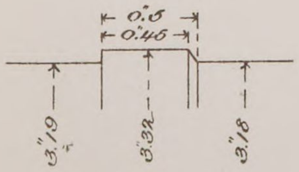
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

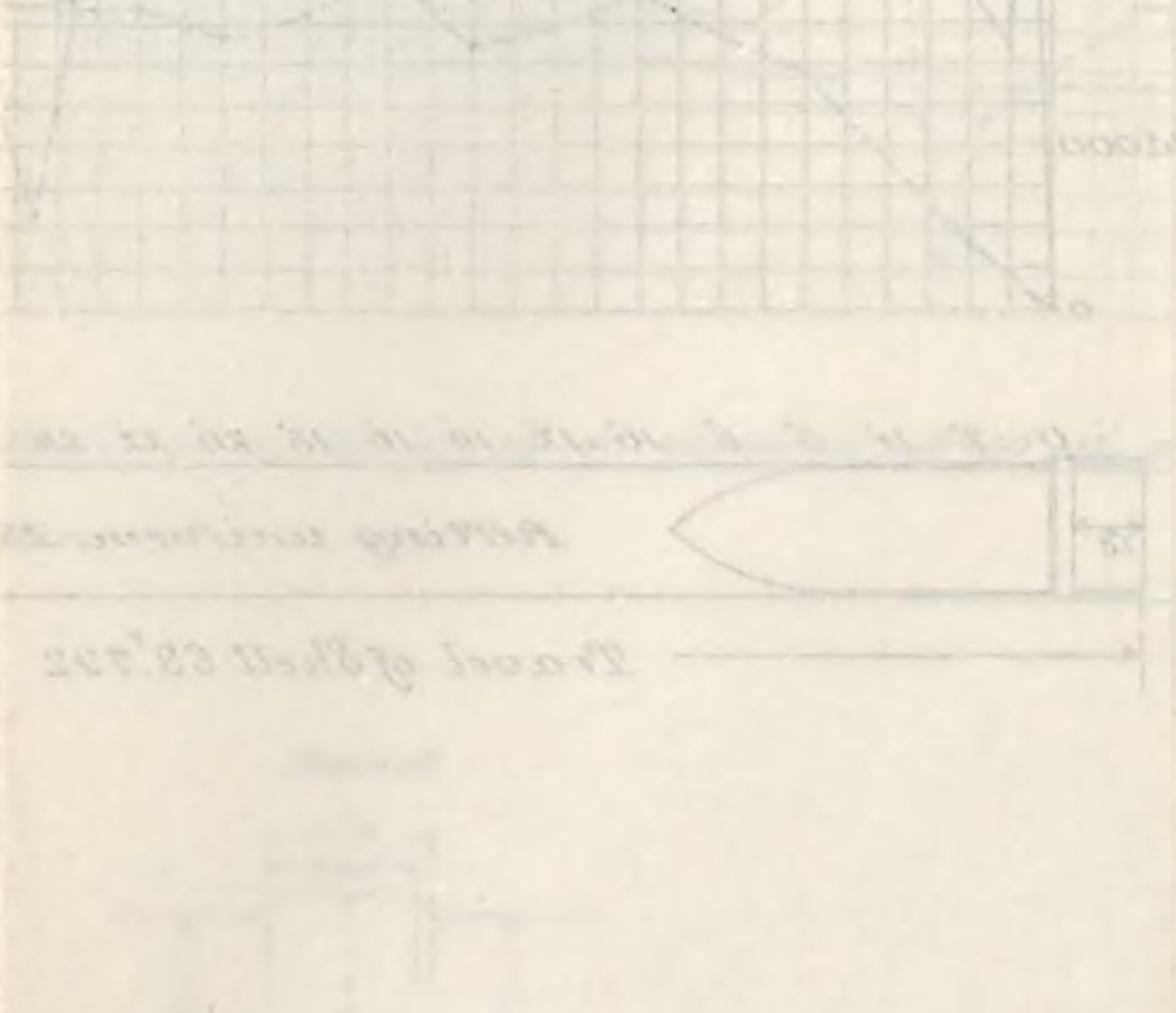
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band



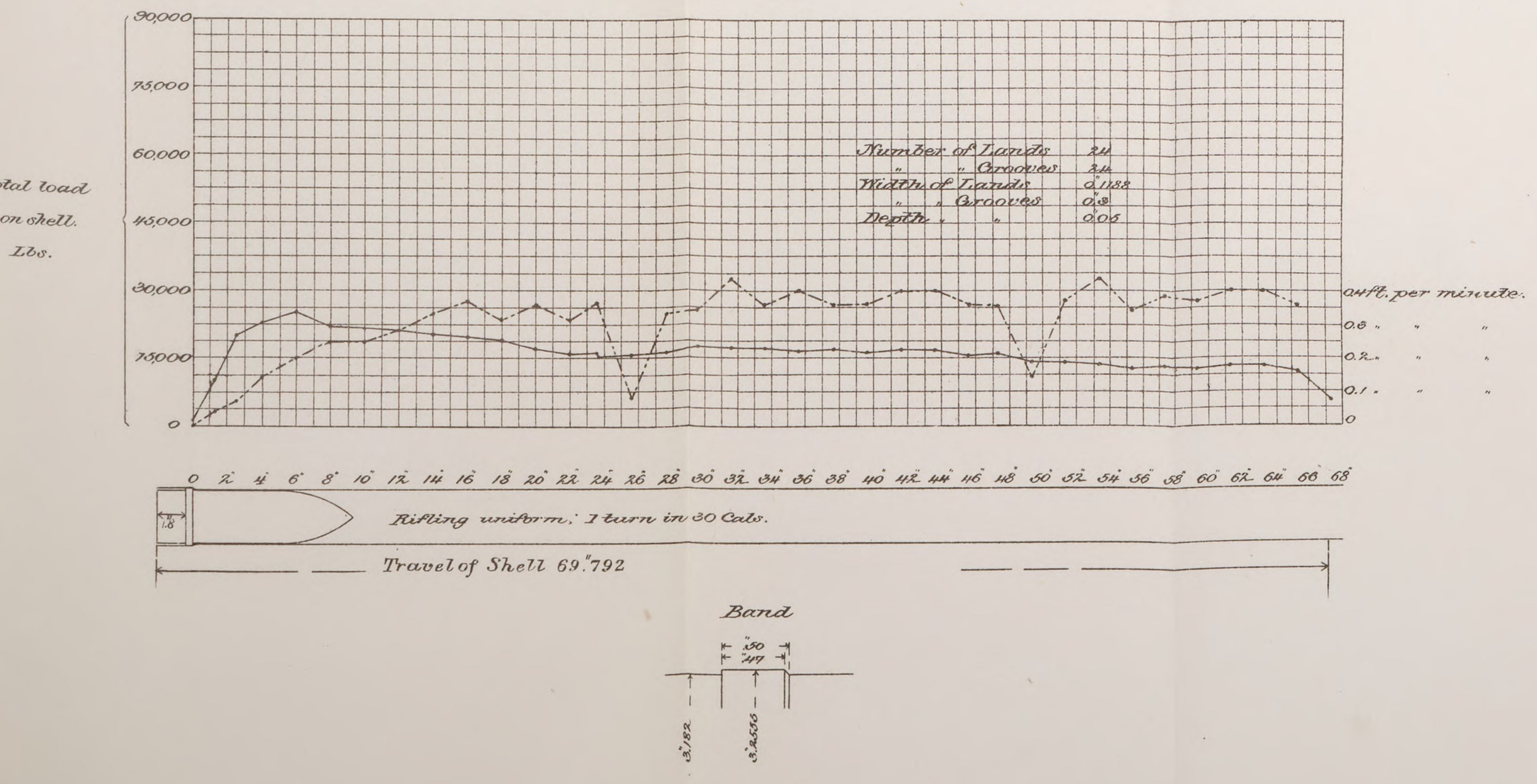


No. 8546.

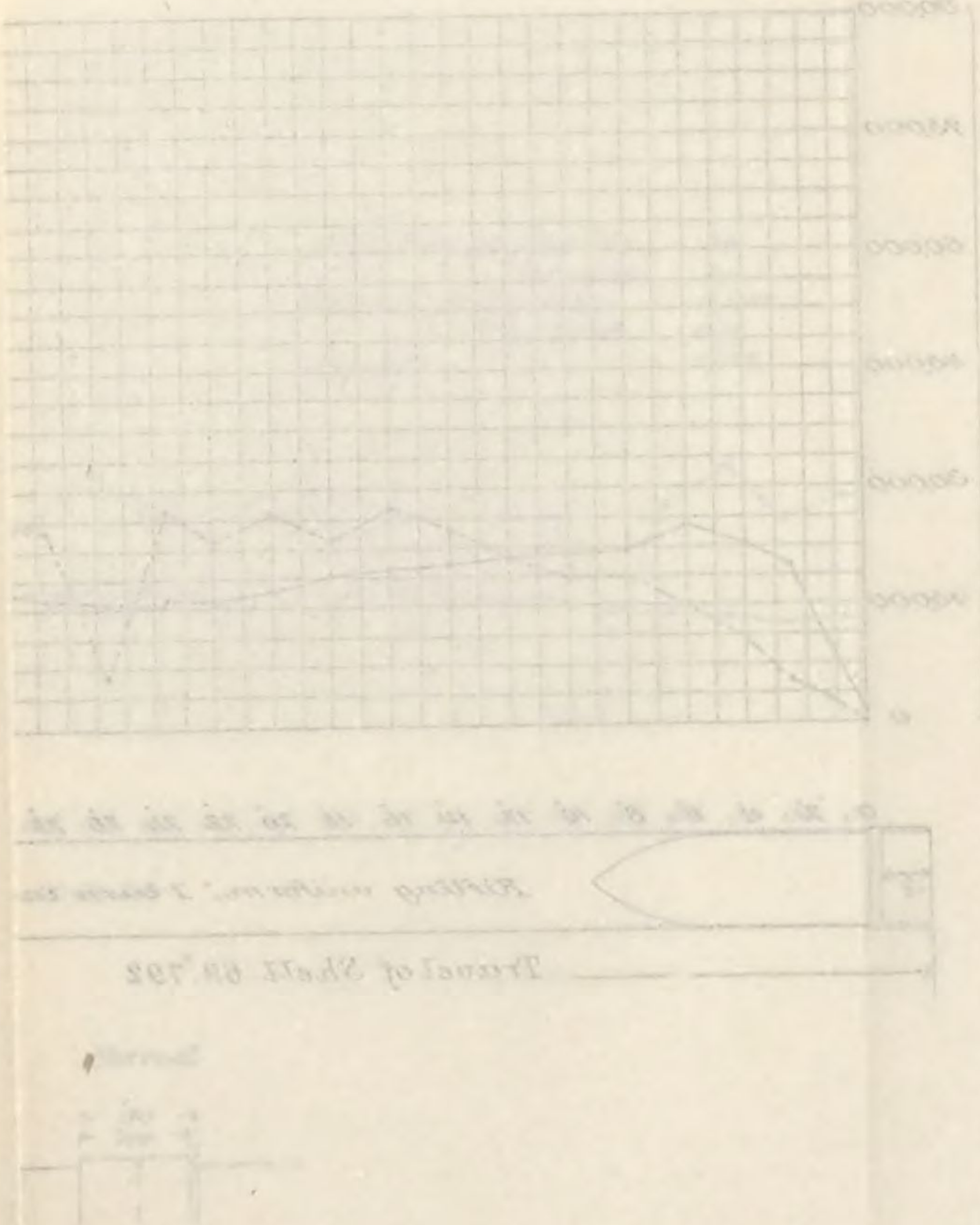
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated



Band

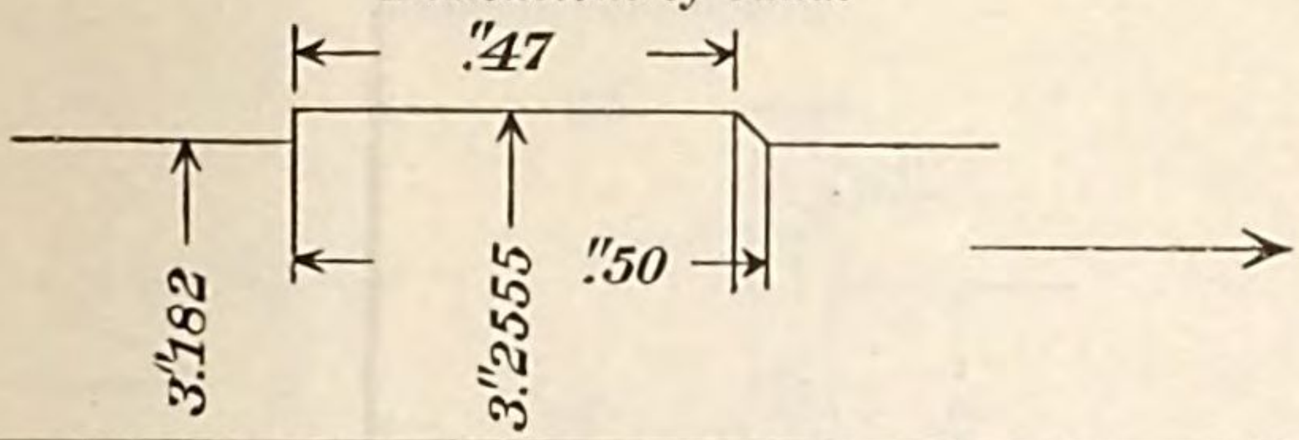


No. 8546.

Bore not lubricated.

Follower attached to antifriction nut, and shell pushed through the gun.

Dimensions of band.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	2 31 00	Initial load.
2,000	.17	.....	.....	
3,000	.30	.....	.....	
4,000	.44	.....	.....	
5,000	.57	.....	.....	
6,000	.71	.....	.....	
7,000	.85	.....	.....	
8,000	.96	.....	.....	
9,000	1.10	.....	.....	
10,000	1.22	.041	2 33 30	
12,000	1.46	.....	.....	
14,000	1.78	.....	.....	
16,000	2.00	.....	.....	
20,000	2.55	.066	35 10	
22,700	4.00	.145	2 36 00	
25,200	6.00	.200	36 50	
22,300	8.00	.250	37 30	
21,900	10.00	.250	38 10	
21,200	12.00	.286	38 45	
20,400	14.00	.333	39 15	
19,900	16.00	.370	39 42	
18,800	18.00	.312	40 14	
16,900	20.00	.357	40 42	
15,900	22.00	.312	41 14	
16,200	23.60	.364	41 36	
				New stroke of piston.
.....	.....	.....	2 52 00	Test resumed.
15,100	23.65	.....	.....	
15,600	25.60	.083	2 54 00	
16,300	27.60	.333	54 30	
17,400	29.60	.345	54 59	
17,300	31.60	.435	55 22	
17,200	33.60	.357	55 50	
16,500	35.60	.400	56 15	
16,900	37.60	.357	56 42	
16,000	39.60	.357	57 10	
16,800	41.60	.400	57 35	
16,700	43.60	.400	58 00	
15,300	45.60	.357	58 28	
15,500	47.30	.354	58 52	
				New stroke of piston.
.....	.....	.....	3 07 30	Test resumed.
14,000	47.32	.....	.....	
14,100	49.30	.147	3 08 38	
14,100	51.30	.370	09 05	
13,800	53.30	.435	09 28	
12,600	55.30	.345	09 57	
13,400	57.30	.385	10 23	
12,500	59.30	.370	10 50	
13,500	61.30	.400	11 15	
13,500	63.30	.400	11 40	
11,800	65.30	.357	12 08	
5,000	67.30	.....	.....	

The lands of the gun sheared their way through the length of the band, and threw up a burr on each edge.

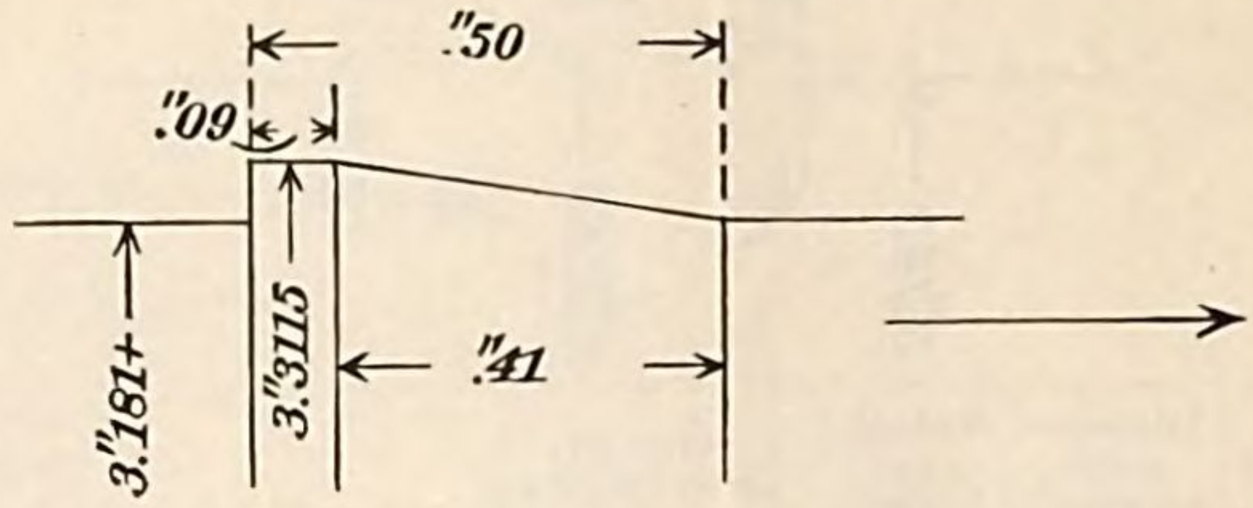
Filing off these burrs and measuring the band on a diameter which was covered by the grooves in the gun the band now measured 3″.2678 diameter at the middle of its length, thus showing an enlargement of (3.2678—3.2555) ″.0123 over the original diameter of the band.

The band was crowning after the test, being sensibly larger in diameter at the middle of its length.

No. 8547.

Bore not lubricated.
Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	8 34 30	Initial load.
5,000	.01	.....	.....	
10,000	.02	.....	.....	
15,000	.03	.....	.....	
20,000	.07	.....	.....	
21,200	.11	.004	8 37 00	
15,000	.26	.....	.....	
12,500	.58	.....	.....	
14,000	1.00	.049	38 30	
17,700	2.00	.125	39 10	
21,800	3.00	.167	39 40	
23,100	4.00	.125	40 20	
24,800	6.00	.250	41 00	
22,400	8.00	.250	8 41 40	
22,500	10.00	.294	42 14	
22,800	12.00	.323	42 45	
22,500	14.00	.345	43 14	
22,100	16.00	.333	43 44	
20,200	18.00	.345	44 13	
18,300	20.00	.345	44 42	
17,800	22.00	.357	45 10	
17,600	23.69	.384	45 32	
				New stroke of piston.
.....	.....	.....	8 54 40	Test resumed.
18,000	23.71	.....	.....	
17,200	24.69	.....	.....	
17,600	25.69	.102	8 56 18	
17,900	27.69	.312	56 50	
18,200	29.69	.333	57 20	
17,500	31.69	.370	57 47	
17,100	33.69	.345	58 16	
16,300	35.69	.385	58 42	
16,200	37.69	.357	59 10	
16,000	39.69	.385	59 36	
15,900	41.69	.357	9 00 04	
16,900	43.69	.385	00 30	
19,900	45.69	.385	00 56	
15,600	47.44	.357	01 24	
				New stroke of piston.
.....	.....	.....	9 10 40	Test resumed.
15,600	47.45	.....	.....	
15,400	48.44	.089	9 11 36	
15,100	49.44	.227	11 58	
14,000	51.44	.238	12 40	
14,400	53.44	.263	13 18	
13,500	55.44	.400	13 43	
13,500	57.44	.312	14 15	
13,200	59.44	.370	14 42	
13,600	61.44	.385	15 08	
14,000	63.44	.400	15 33	
12,400	65.44	.385	15 59	
6,500	67.40	.323	16 30	

Diameter over band opposite grooves in the gun after the test, about 3.3″10.

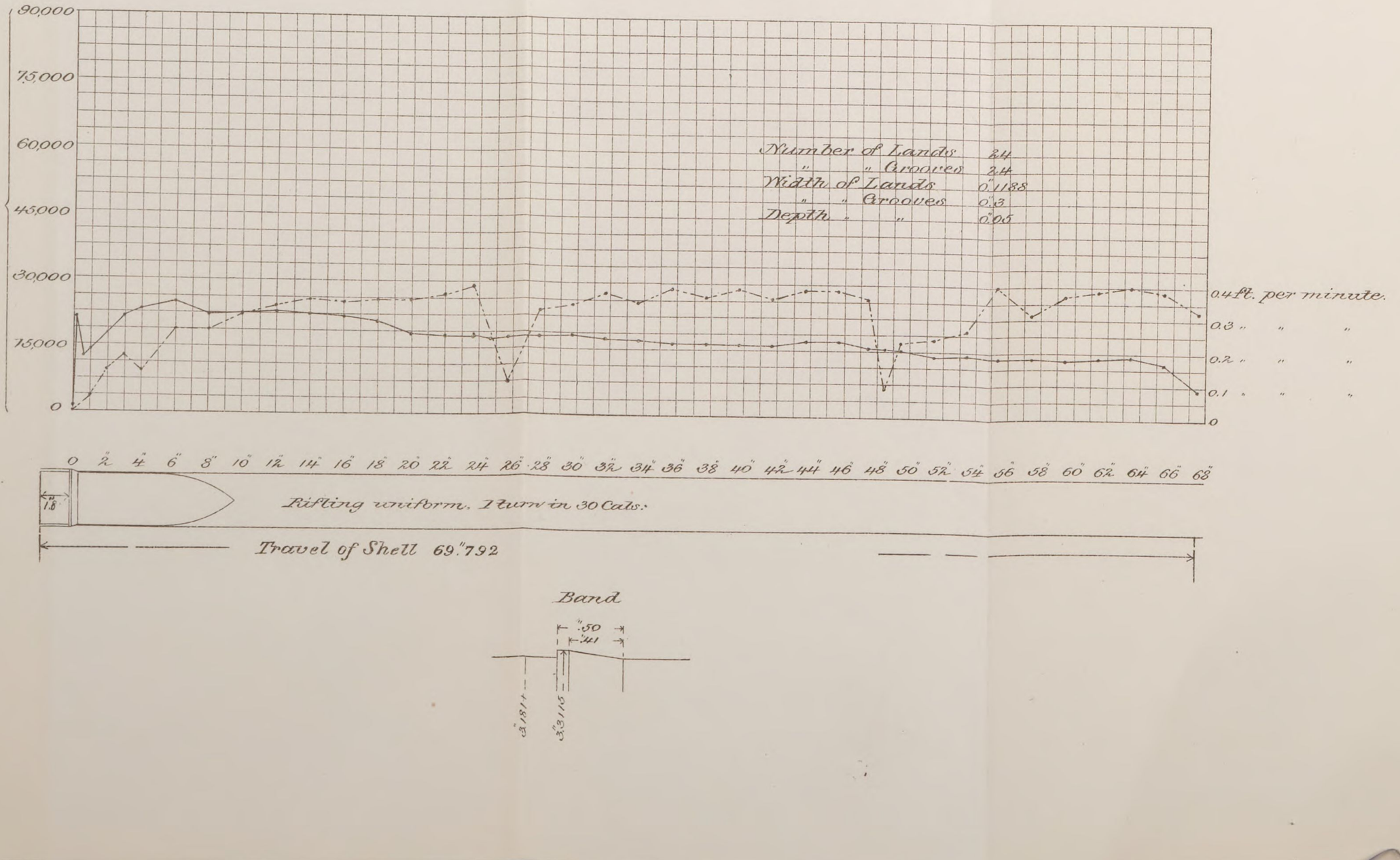
Copper in the band, opposite the lands, flowed to the rear about ″.18±.

No. 8547.

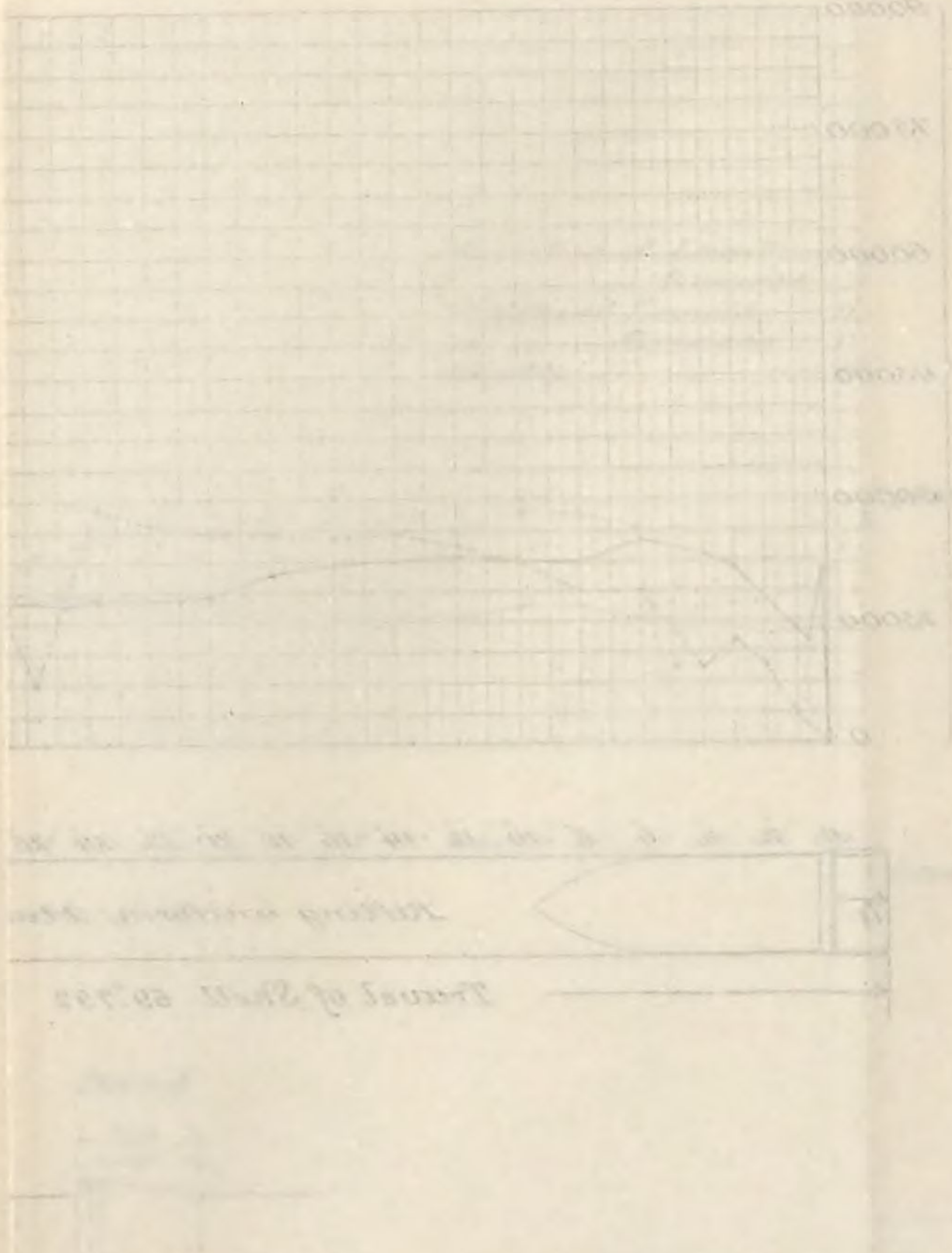
3.2-inch Driggs-Schroeder B. L. Steel Field Rifle.

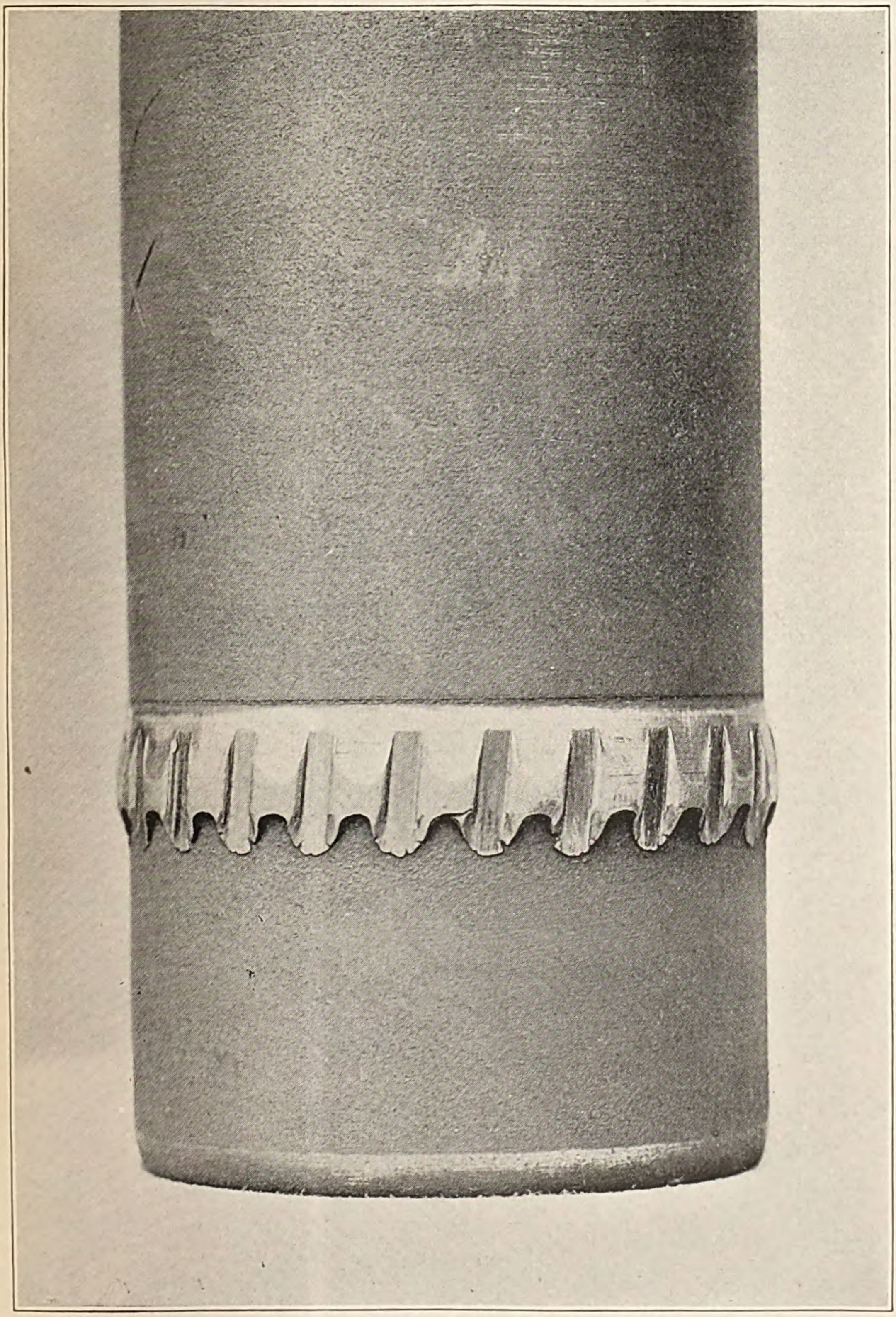
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated.



Band





PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

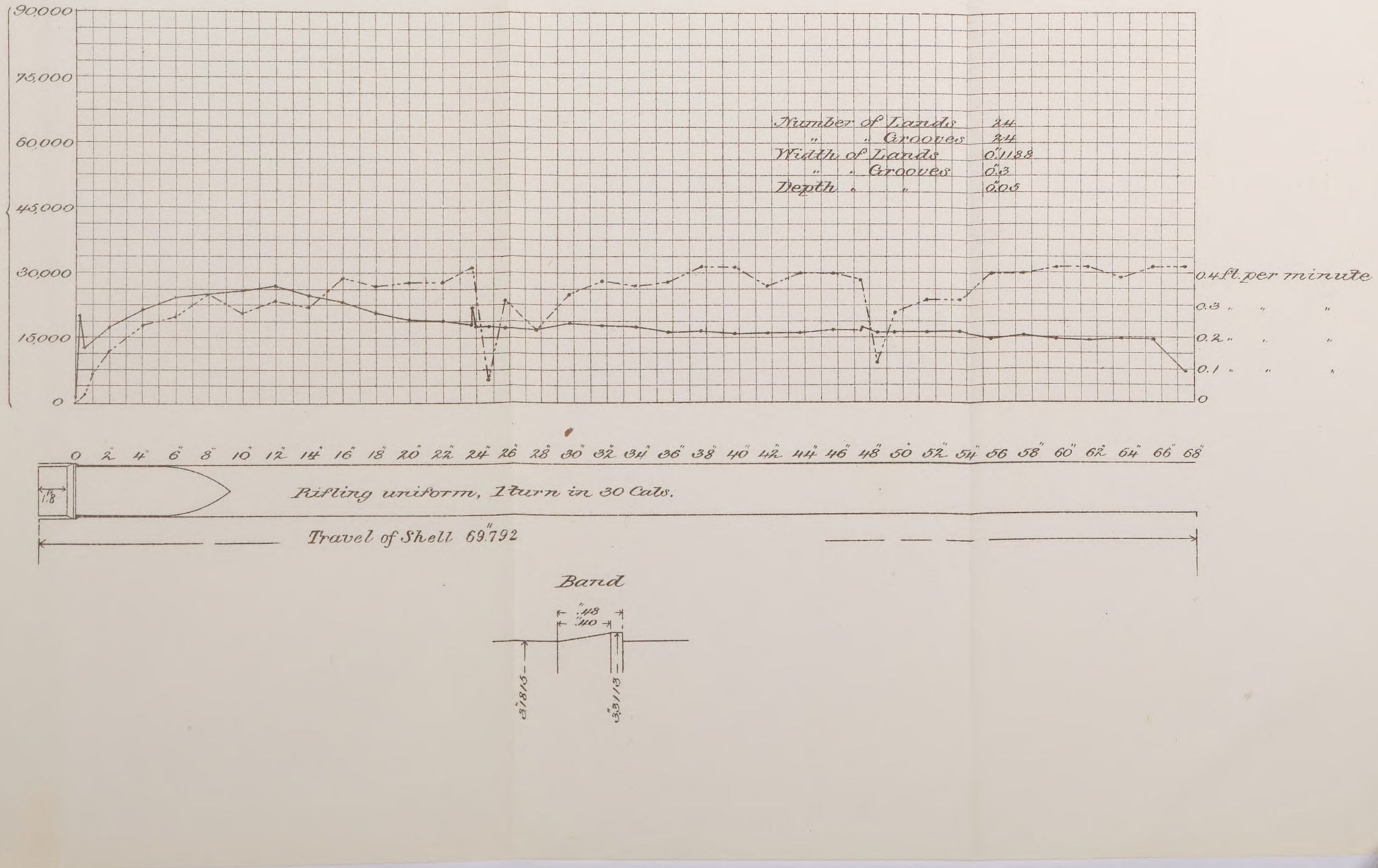
EXPERIMENT No. 8547.

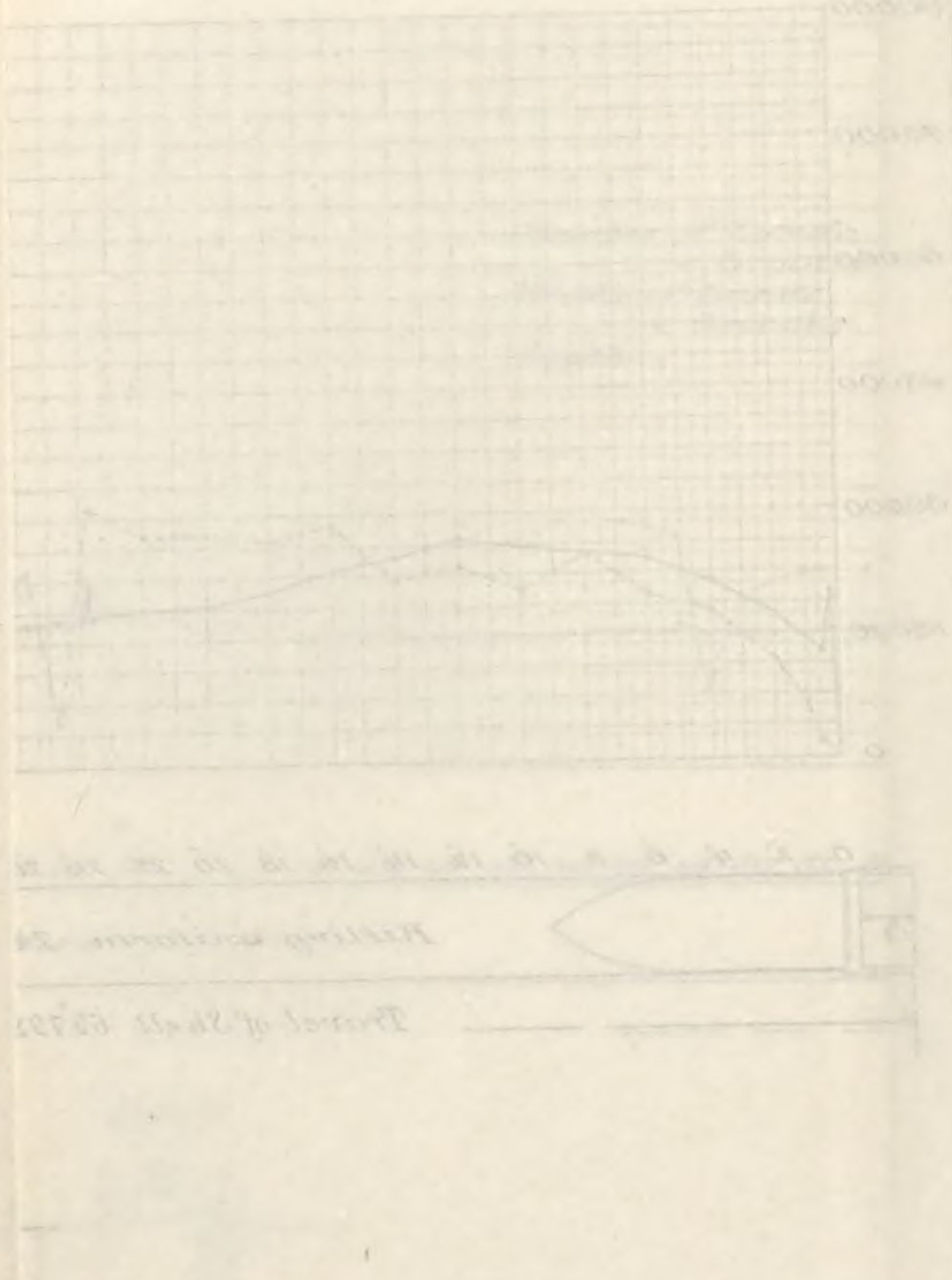
No. 8548.

3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

Bore not lubricated

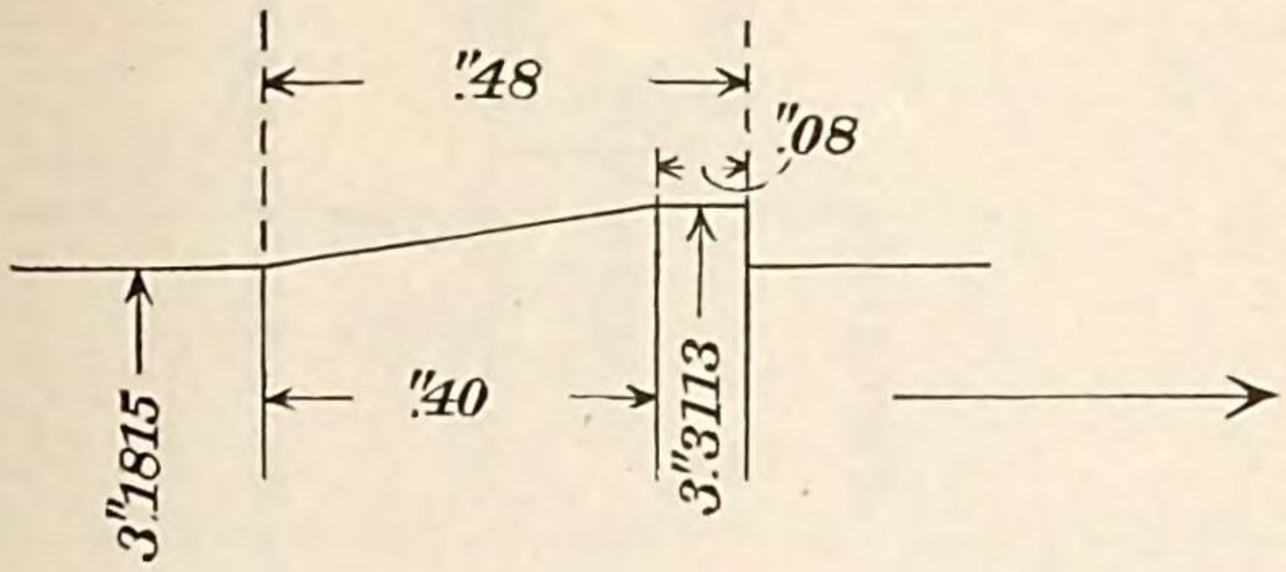




No. 8548.

Bore not lubricated.
Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



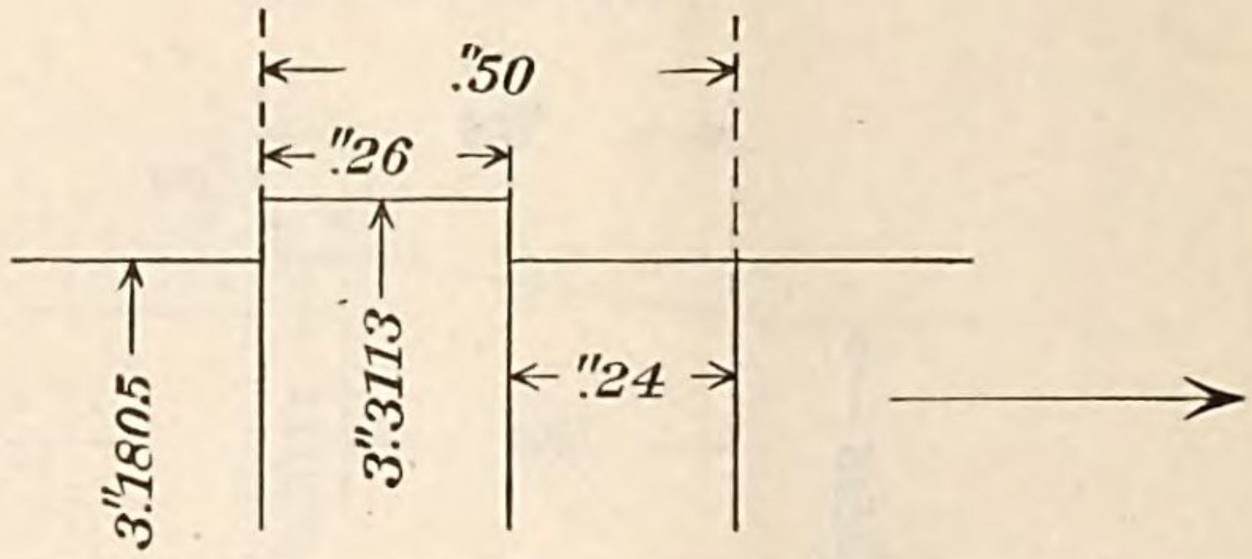
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	9 56 00	Initial load.
10,000	.03	.....	.....	
15,000	.06	.....	.....	
19,500	.12	.....	.....	
20,000	.18	.009	9 57 40	
18,000	.28	.....	.....	
16,000	.35	.018	9 58 28	
12,500	.50	.023	59 00	
14,000	.95	.087	59 26	
17,600	2.00	.154	10 00 00	
21,600	4.00	.238	10 00 42	
24,100	6.00	.263	01 20	
25,100	8.00	.333	01 50	
26,100	10.00	.278	02 26	
26,600	12.00	.312	10 02 58	
24,600	14.00	.294	03 32	
23,000	16.00	.385	03 58	
20,800	18.00	.357	04 26	
19 000	20.00	.370	04 53	
18,800	22.00	.370	05 20	
18,100	23.74	.414	05 41	
.....	.....	.....	10 15 00	New stroke of piston. Test resumed.
22,200	23.76	.....	.....	
17,500	24.04	.....	.....	
17,800	24.74	.058	10 16 26	
17,200	25.74	.312	16 42	
16,900	27.74	.278	17 18	
18,600	29.74	.333	17 48	
18,000	31.74	.370	18 15	
17,600	33.74	.357	18 43	
16,100	35.74	.370	19 10	
16,300	37.74	.417	19 34	
15,600	39.74	.417	19 58	
15,700	41.74	.357	20 26	
15,800	43.74	.400	20 51	
16,800	45.74	.400	21 16	
16,600	47.48	.378	21 39	
.....	.....	.....	10 30 00	New stroke of piston. Test resumed.
17,200	47.51	.....	.....	
16,100	48.48	.119	10 30 42	
16,200	49.48	.278	31 00	
16,200	51.48	.312	31 32	
16,500	53.48	.312	32 04	
14,900	55.48	.400	32 29	
15,200	57.48	.400	32 54	
14,800	59.48	.417	33 18	
14,600	61.48	.417	33 42	
14,900	63.48	.385	34 08	
14,800	65.48	.417	34 32	
7,000	67.48	.417	34 56	

No. 8549.

Bore not lubricated.

Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	11 30 00	Initial load.
10,000	.03	----------	----------	
20,000	.08	----------	----------	
25.000	.13	----------	----------	
26,900	.20	----------	----------	
22,000	.29	----------	----------	
20,000	.34	.008	11 33 30	
16,000	1.00	.110	34 00	
18,300	2.00	.263	34 19	
22,400	4.00	.323	34 50	
25,100	6.00	.263	35 28	
28,800	8.00	.270	36 05	
30,200	10.00	.323	36 36	
31,100	12.00	.357	37 04	
28.100	14.00	.454	11 37 26	
25,200	16.00	.417	37 50	
22,000	18.00	.400	38 15	
20,800	20.00	.400	38 40	
19,600	22.00	.417	39 04	
19,200	23.75	.398	39 26	
				New stroke of piston.
----------	----------	----------	11 47 50	Test resumed.
22,900	23.76	----------	48 30	
18,300	24.75	.112	49 10	
17,100	25.75	.263	49 29	
16,900	27.75	.500	49 49	
19,200	29.75	.323	50 20	
18,600	31.75	.370	50 47	
18,100	33.75	.357	51 15	
16,200	35.75	.385	51 41	
16,400	37.75	.370	52 08	
14,400	39.75	.400	52 33	
14,700	41.75	.370	53 00	
14,100	43.75	.357	53 28	
14,900	45.75	.400	53 53	
14,500	47.45	.340	54 18	
				New stroke of piston.
----------	----------	----------	1 25 10	Test resumed.
18,100	47.46	----------	----------	
15,200	47.55	----------	----------	Throbs.
13,800	48.45	.043	1 27 05	
14,400	49.45	.217	1 27 28	
14,500	51.45	.312	28 00	
15,000	53.45	.385	28 26	
13,500	55.45	.385	28 52	
14,100	57.45	.385	29 18	
13,800	59.45	.417	29 42	
13,400	61.45	.357	30 10	
13,500	63.45	.400	30 35	
13,100	65.45	.370	31 02	
6,000	67.45	.385	31 28	

Copper in the band opposite the lands of the gun flowed to the rear about ″.26 and to the front of the full section of the band from ″.05 to ″.06, thus making contact with the lands a length of about ″.59 to ″.62. The full section of the band measured about ″.28 long after the test.

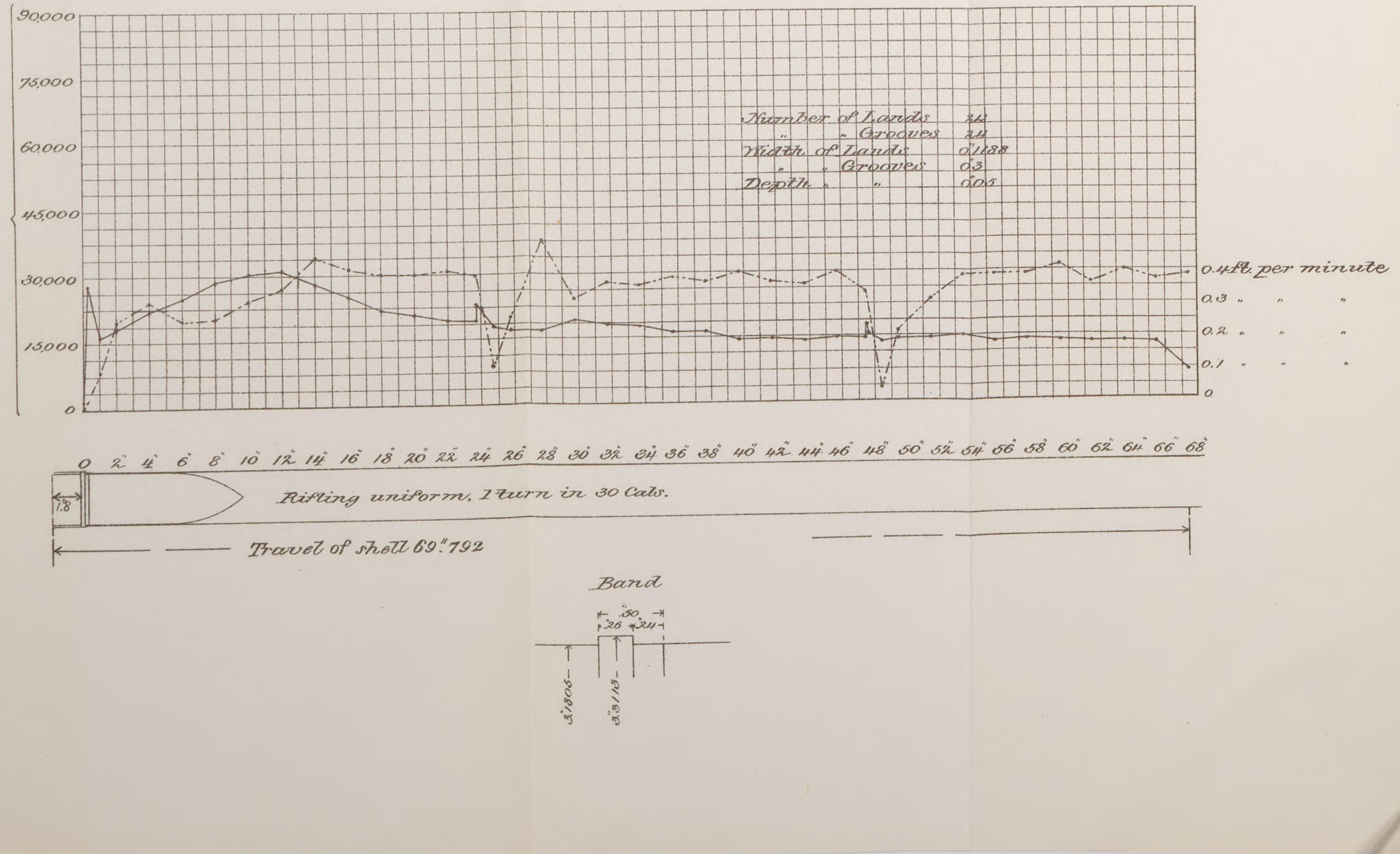
Diameter of band over grooves in the gun after the test, 3″.3097.

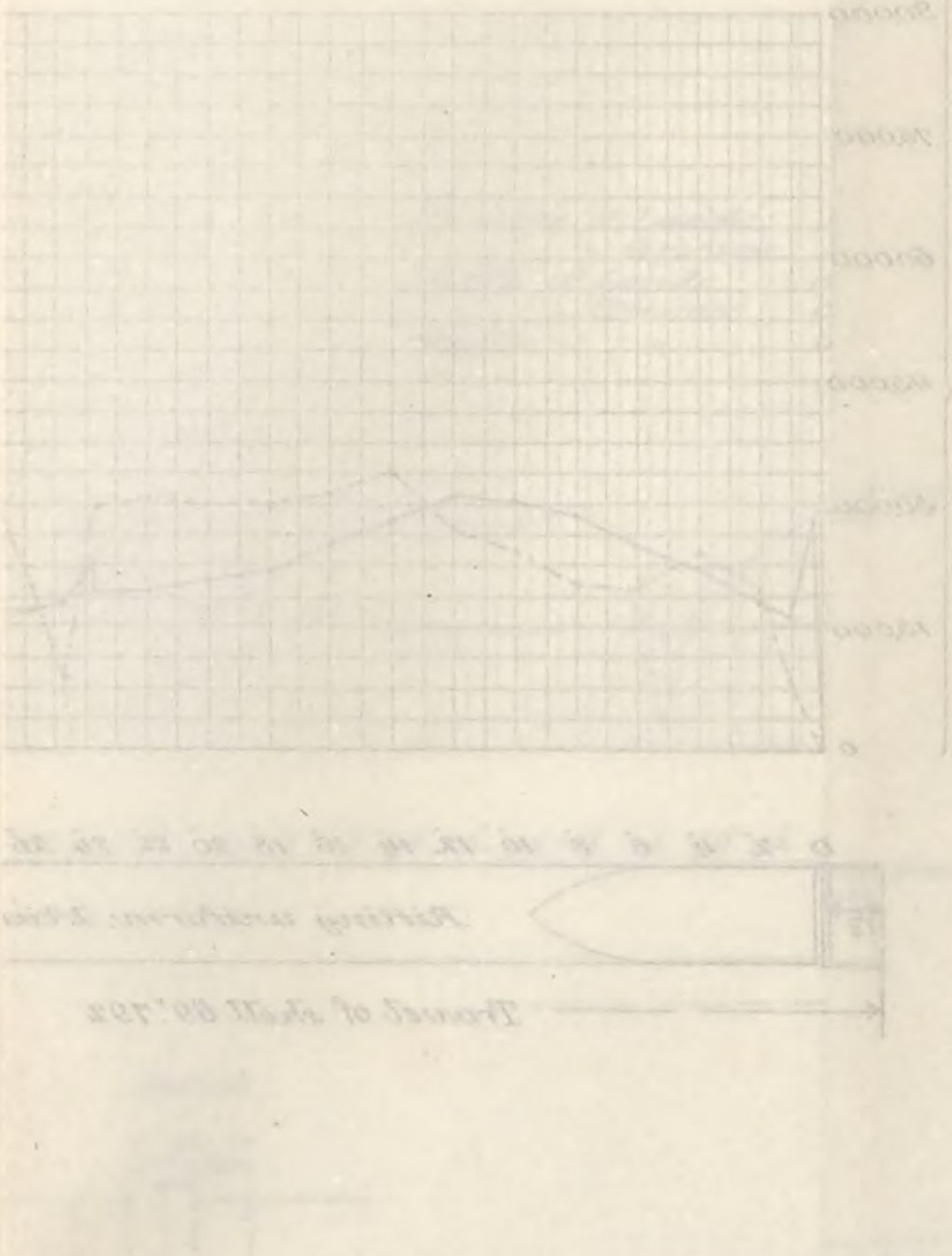
No. 8549.

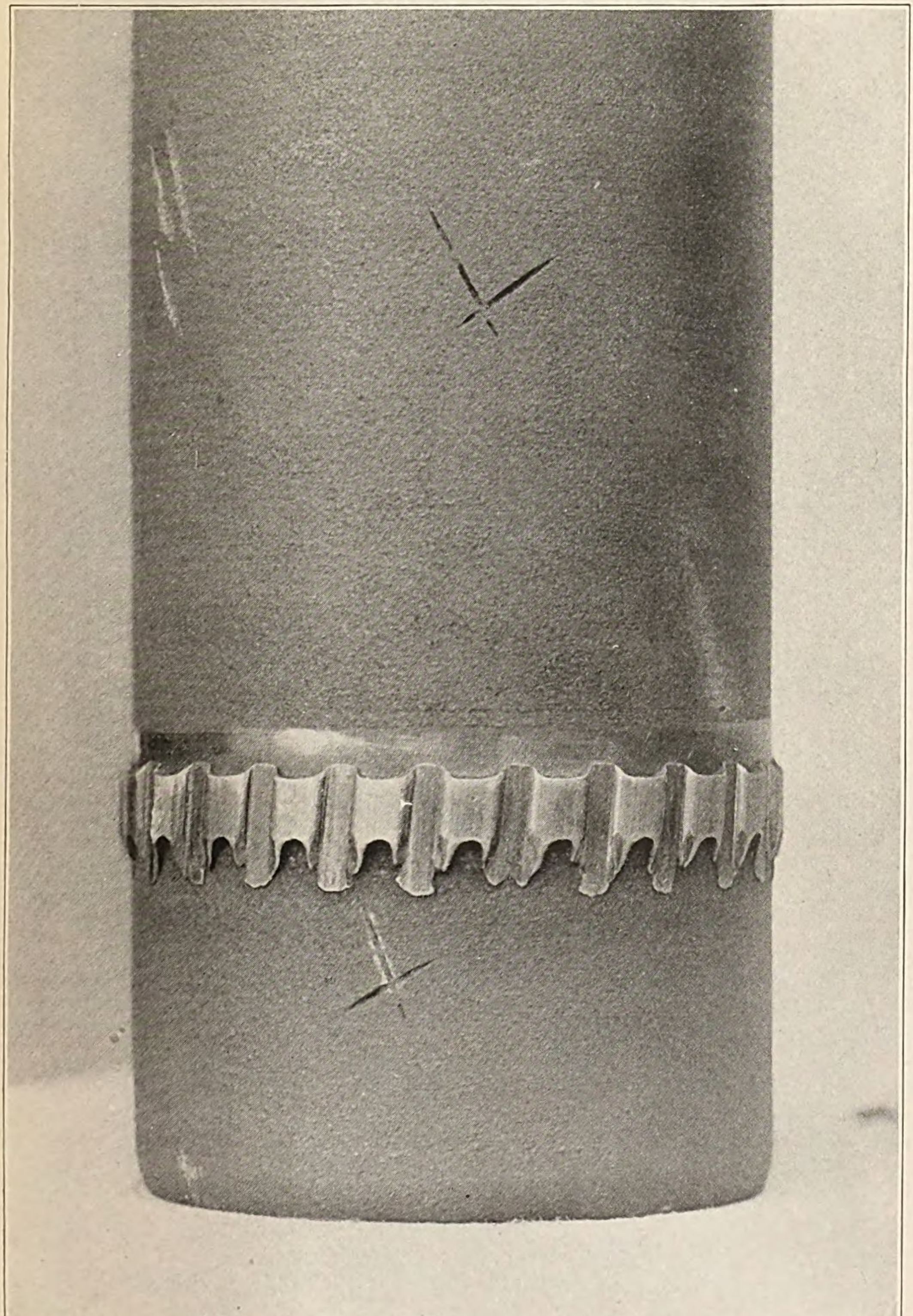
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated.

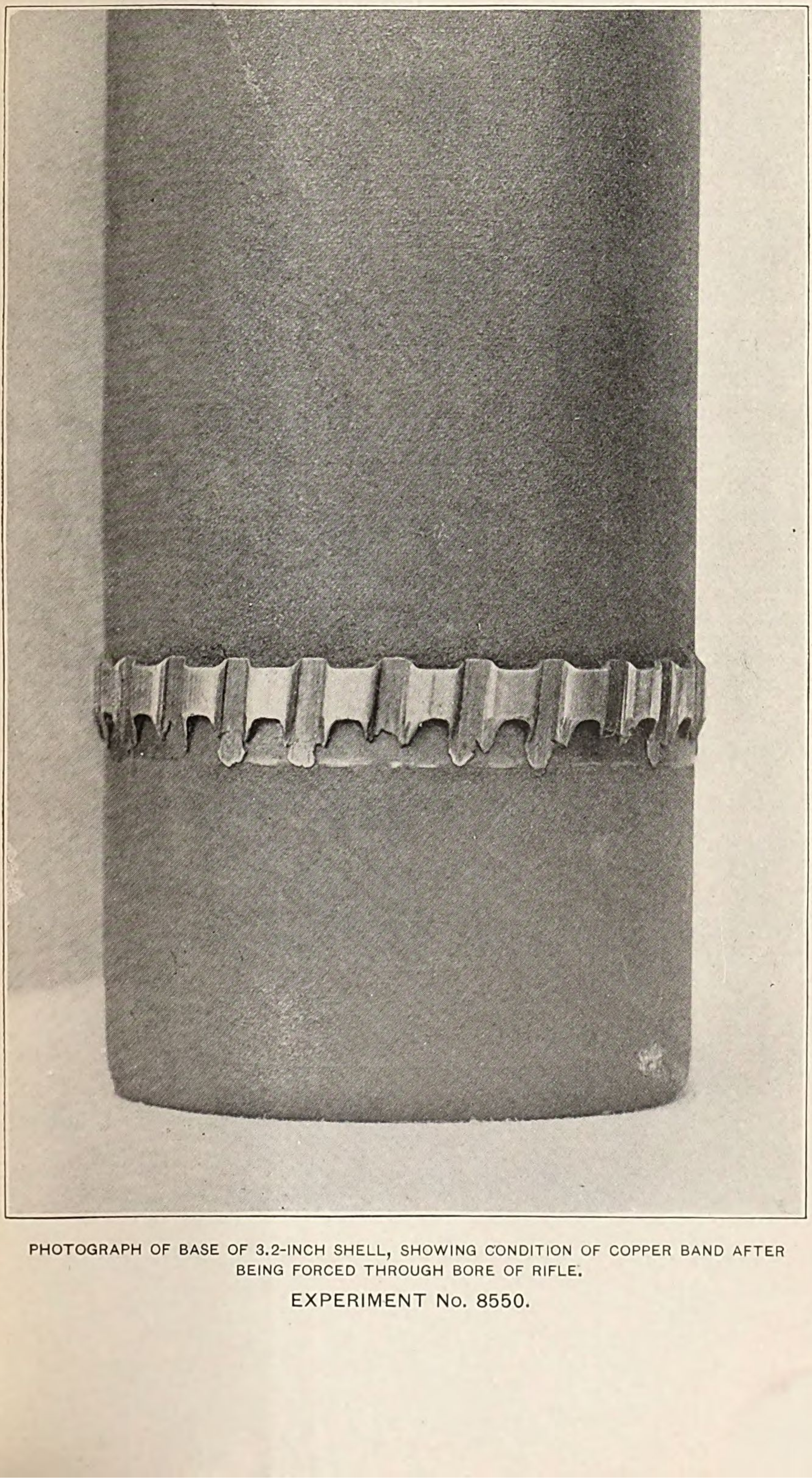






PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

EXPERIMENT No. 8549.



PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

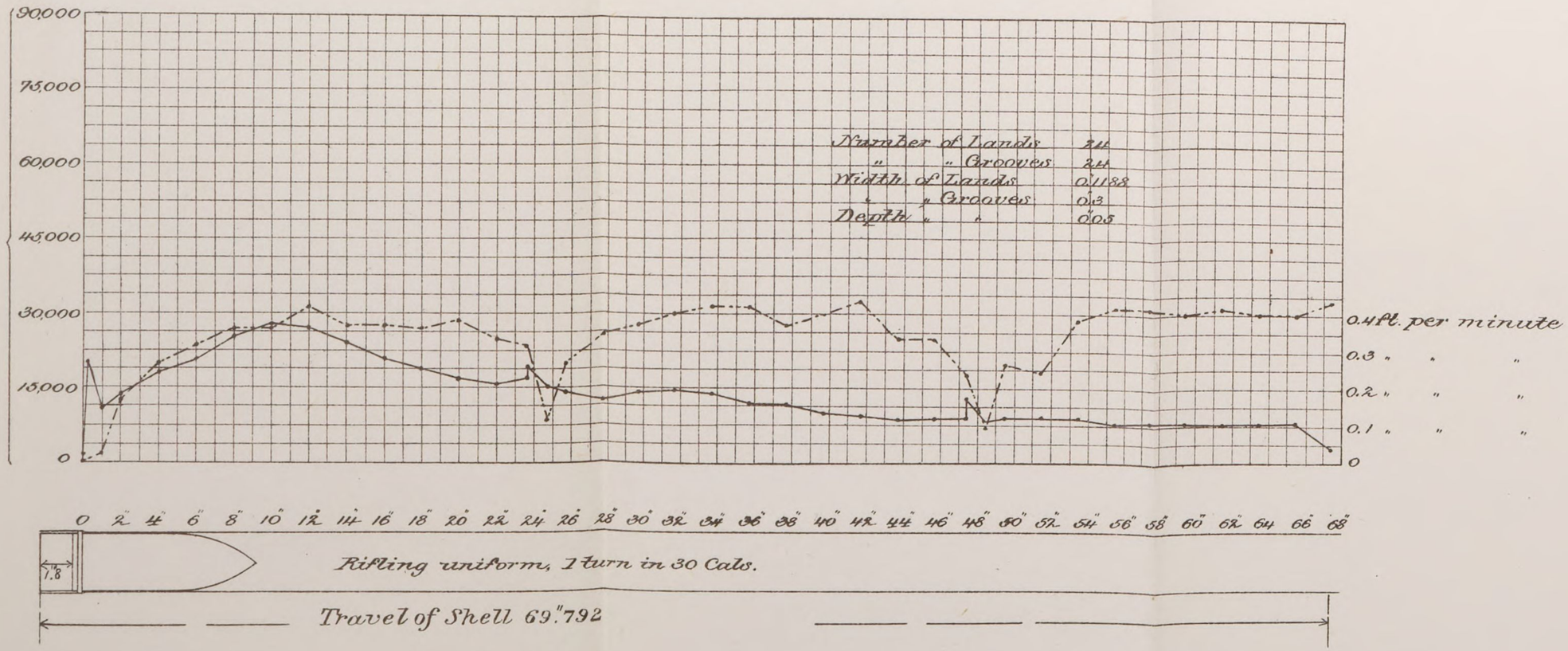
EXPERIMENT No. 8550.

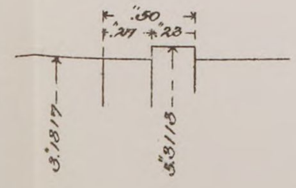
No. 8550.

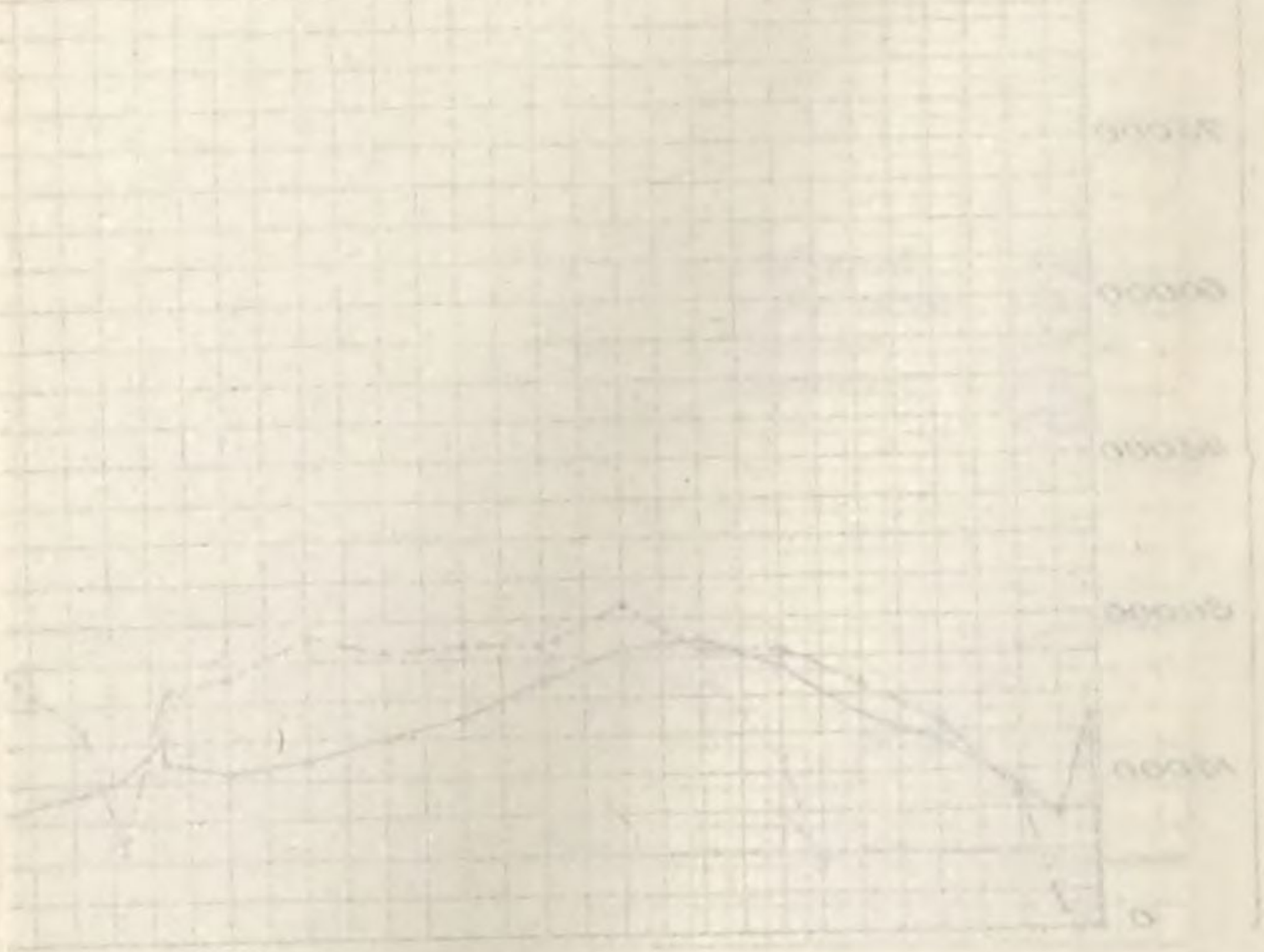
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

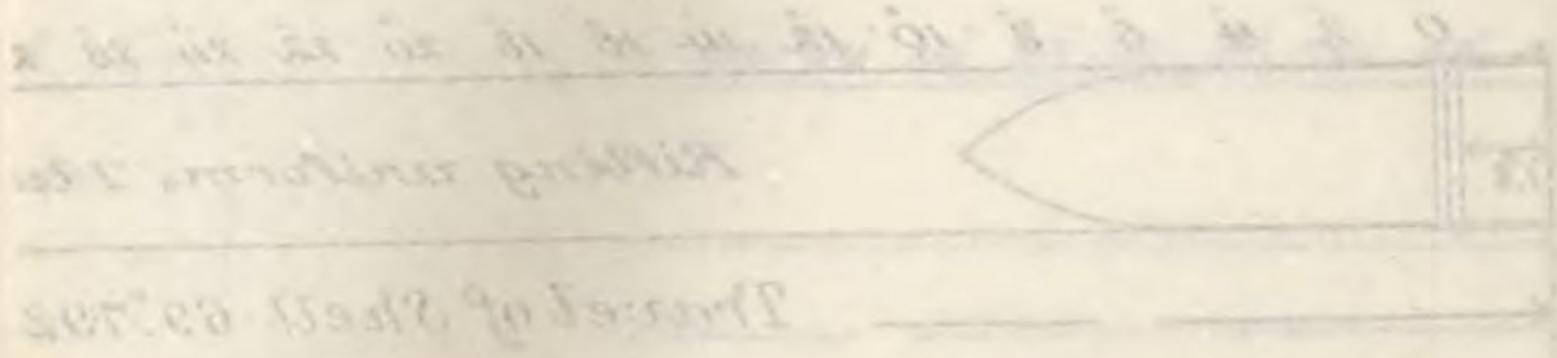
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated.





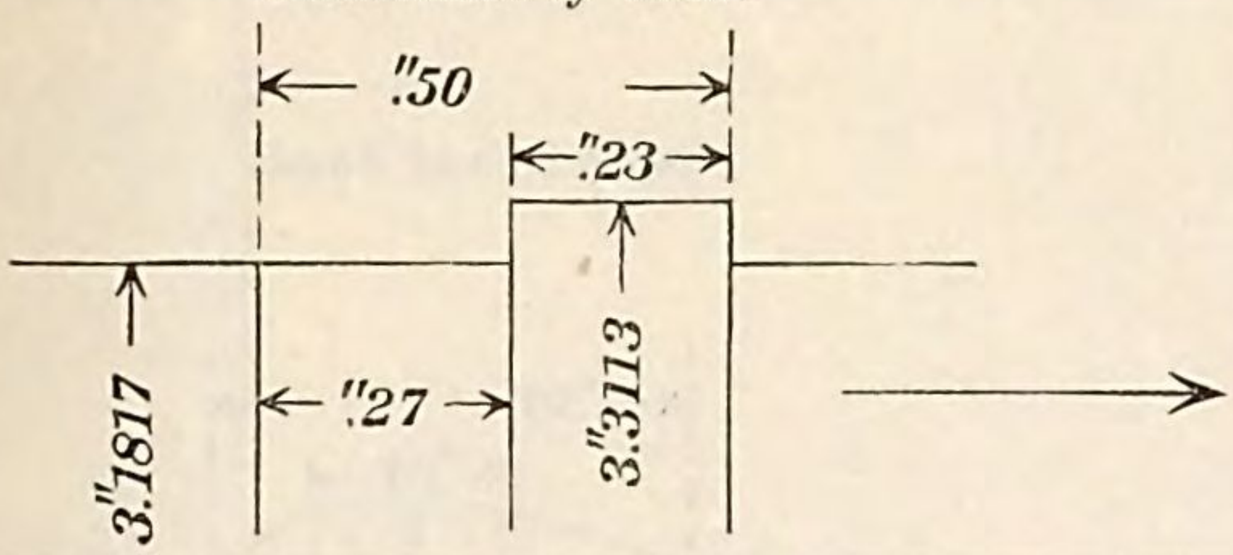




No. 8550.

Bore not lubricated.
Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	2 22 00	Initial load.
10,000	.03	.....	.....	
20,000	.13	.....	.....	
20,000	.23	.....	.....	
18,000	.25	.....	.....	
15,000	.32	.....	.....	
12,000	.42	.....	.....	
11,000	.49	.....	.....	
10,600	.80	.....	.....	
10,900	1.00	025	2 25 20	
13,700	2.00	.167	25 50	
18,100	4.00	.263	26 28	
20,500	6.00	.312	27 00	
25,200	8.00	.357	27 28	
27,700	10.00	.357	2 27 56	
27,000	12.00	.417	28 20	
24,100	14.00	.370	28 47	
20,800	16.00	.370	29 14	
18,800	18.00	.357	29 42	
16,900	20.00	.385	30 08	
15,600	22.00	.333	30 38	
16,800	23.70	.315	31 05	
.....	.....	.....	2 39 15	New stroke of piston. Test resumed.
19,000	23.74	.....	.....	
15,100	24.70	.111	2 40 00	
13,900	25.70	.263	40 19	
12,200	27.70	.345	40 48	
14,000	29.70	.370	41 15	
14,600	31.70	.400	41 40	
13,900	33.70	.417	42 04	
11,800	35.70	.417	42 28	
11,300	37.70	.370	42 55	
9,900	39.70	.400	43 20	
9,500	41.70	.435	43 43	
8,600	43.70	.333	44 13	
9,000	45.70	.333	44 43	
9,100	47.46	.238	45 20	
.....	.....	.....	2 52 20	New stroke of piston. Test resumed.
13,000	47.48	.....	.....	
8,200	48.46	.096	2 53 12	
9,100	49.46	.263	53 31	
9,100	51.46	.244	54 12	
9,000	53.46	.385	54 38	
7,600	55.46	.417	55 02	
8,300	57.46	.417	55 26	
7,900	59.46	.400	55 51	
7,700	61.46	.417	56 15	
7,700	63.46	.400	56 40	
8,000	65.46	.400	57 05	
3,000	67.46	.435	57 28	

The metal in the band flowed in a forward direction about ".05, and to the rear from ".15 to ".20.

The rear sections under the lands were irregular in shape, and some were detached from the main part of the band.

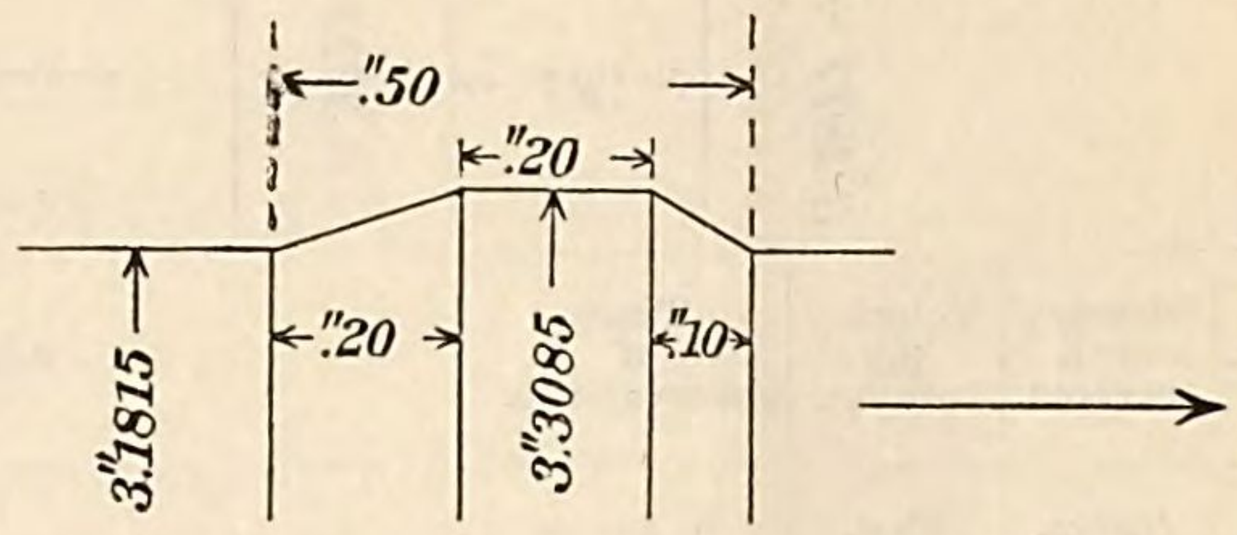
Diameter of band over grooves in the gun after the test, 3".3068.

No. 8551.

Bore not lubricated.

Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



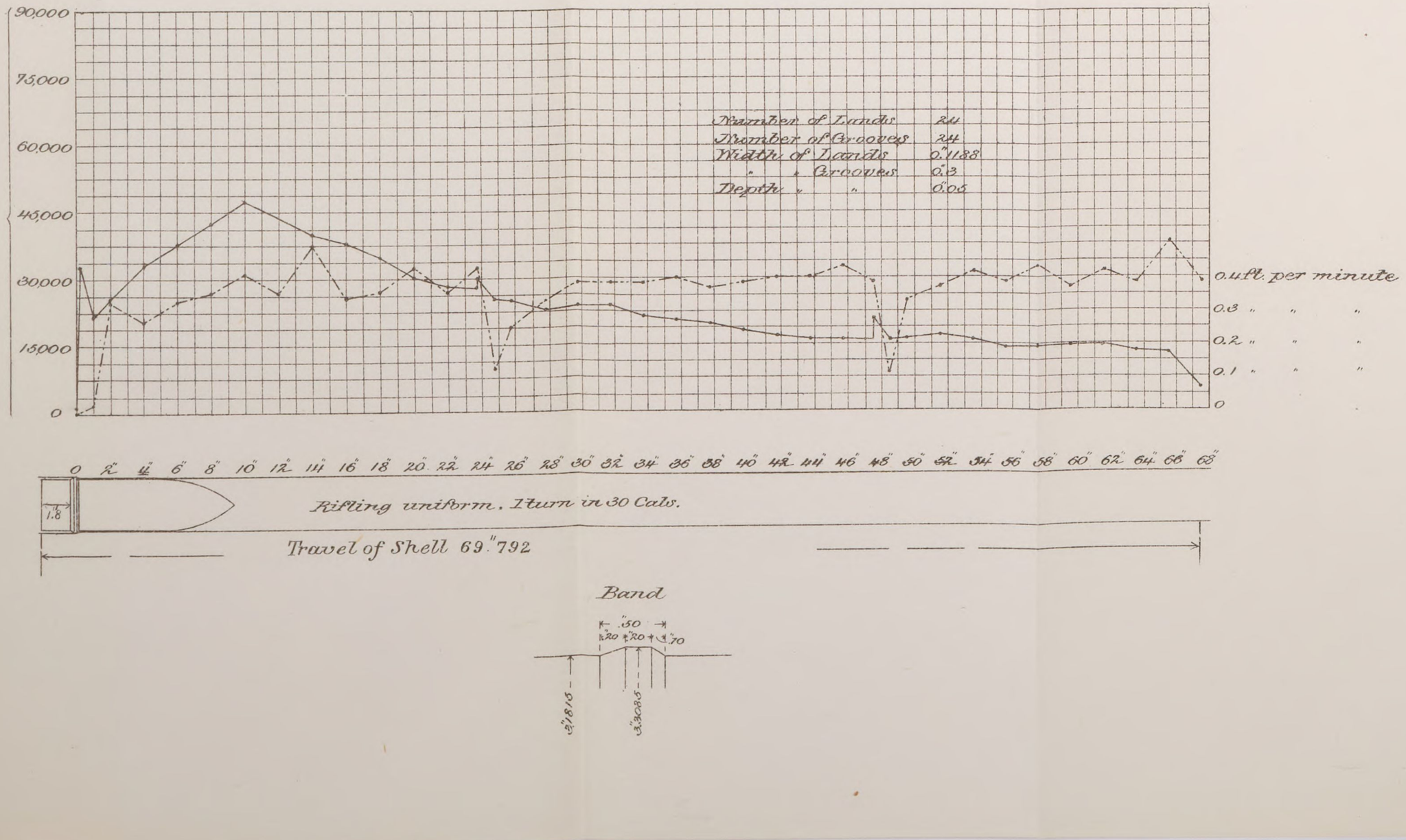
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	3 46 00	Initial load.
15,000	.04	.....	.....	
20,000	.06	.....	.....	
25,000	.08	.....	.....	
28,000	.11	.....	.....	
30,000	.14	.....	.....	
32,000	.16	.....	.....	
32,800	.19	.....	.....	
32,000	.22	.....	.....	
31,000	.25	.....	.....	
29,000	.28	.....	.....	
21,500	1.00	.024	3 49 28	
25,700	2.00	.333	49 43	
33,200	4.00	.270	50 20	
37,600	6.00	.333	3 50 50	
42,400	8.00	.357	51 18	
47,400	10.00	.417	51 42	
43,800	12.00	.357	52 10	
40,000	14.00	.500	52 30	
37,800	16.00	.345	52 59	
34,600	18.00	.357	53 27	
31,000	20.00	.435	53 50	
28,400	22.00	.357	54 18	
28,100	23.73	.432	54 38	
				New stroke of piston.
.....	.....	.....	4 02 00	Test resumed.
30,000	23.75	.....	.....	
25,500	24.73	.125	4 02 40	
25.300	25.73	.250	03 00	
22,600	27.73	.333	03 30	
23,700	29.73	.385	03 56	
23,900	31.73	.385	04 22	
21,700	33.73	.385	04 48	
20,500	35.73	.400	05 13	
19,700	37.73	.370	05 40	
18,100	39.73	.385	06 06	
16,800	41.73	.400	06 31	
16,400	43.73	.400	06 56	
16,400	45.73	.435	07 19	
16,300	47.51	.387	07 42	
				New stroke of piston.

No 8551.

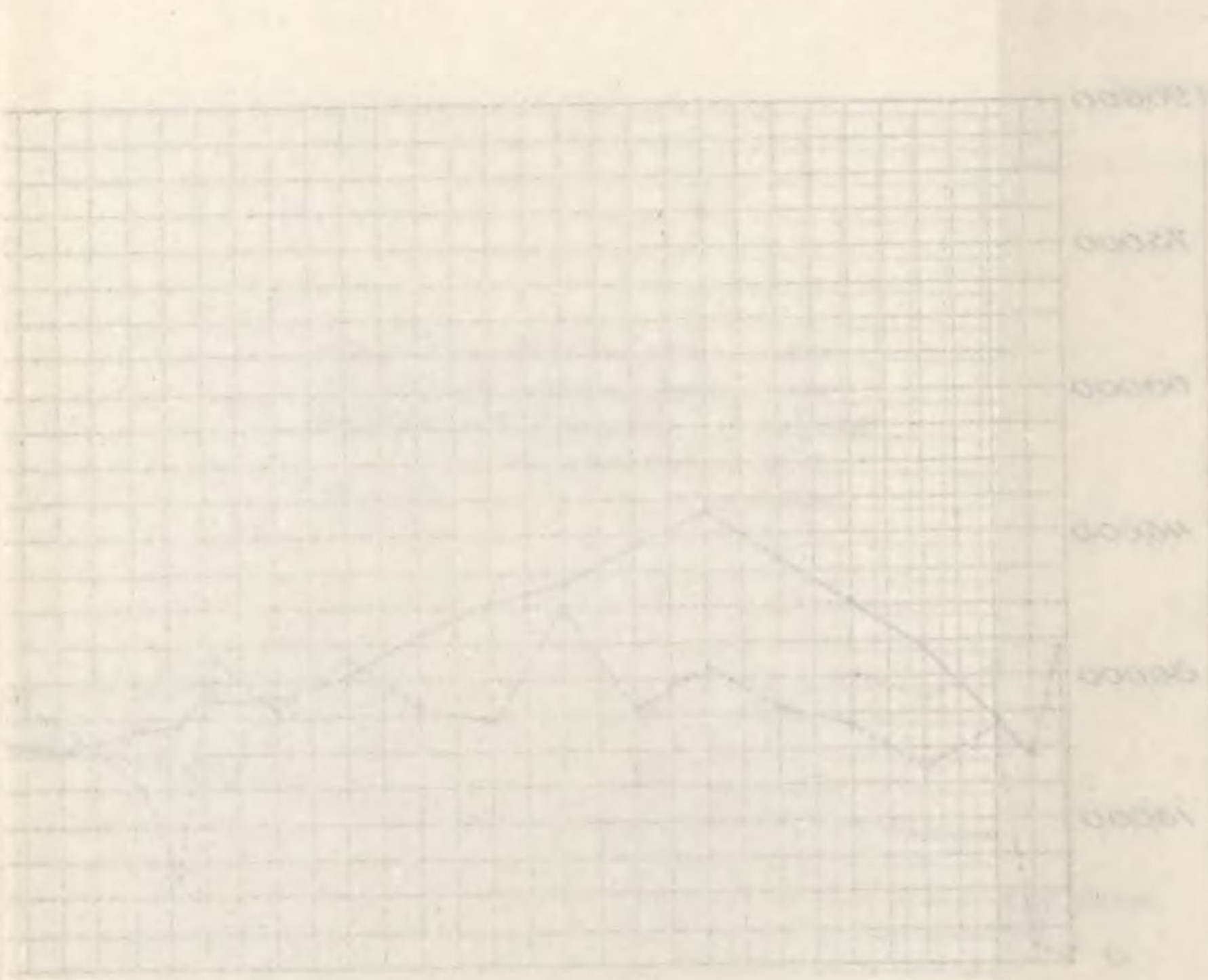
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

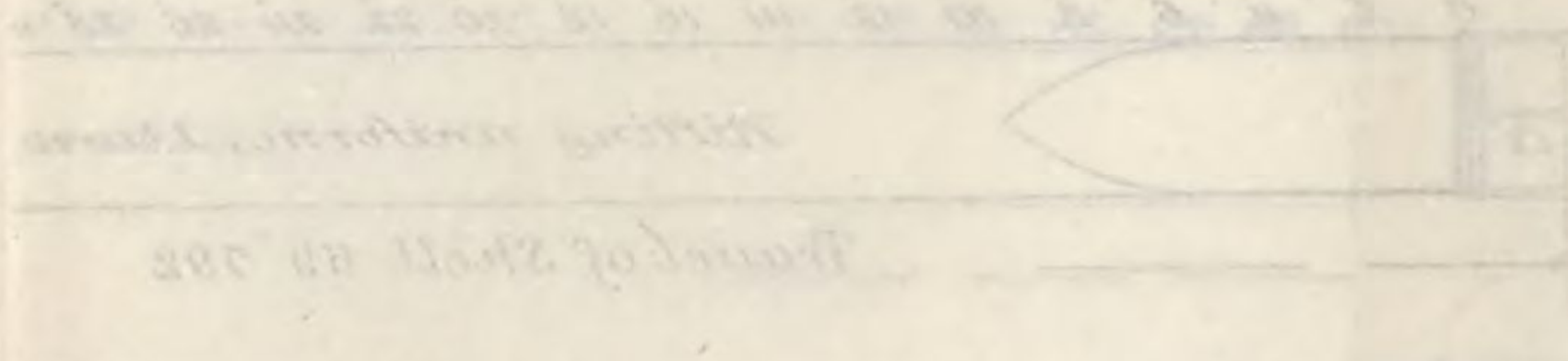
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

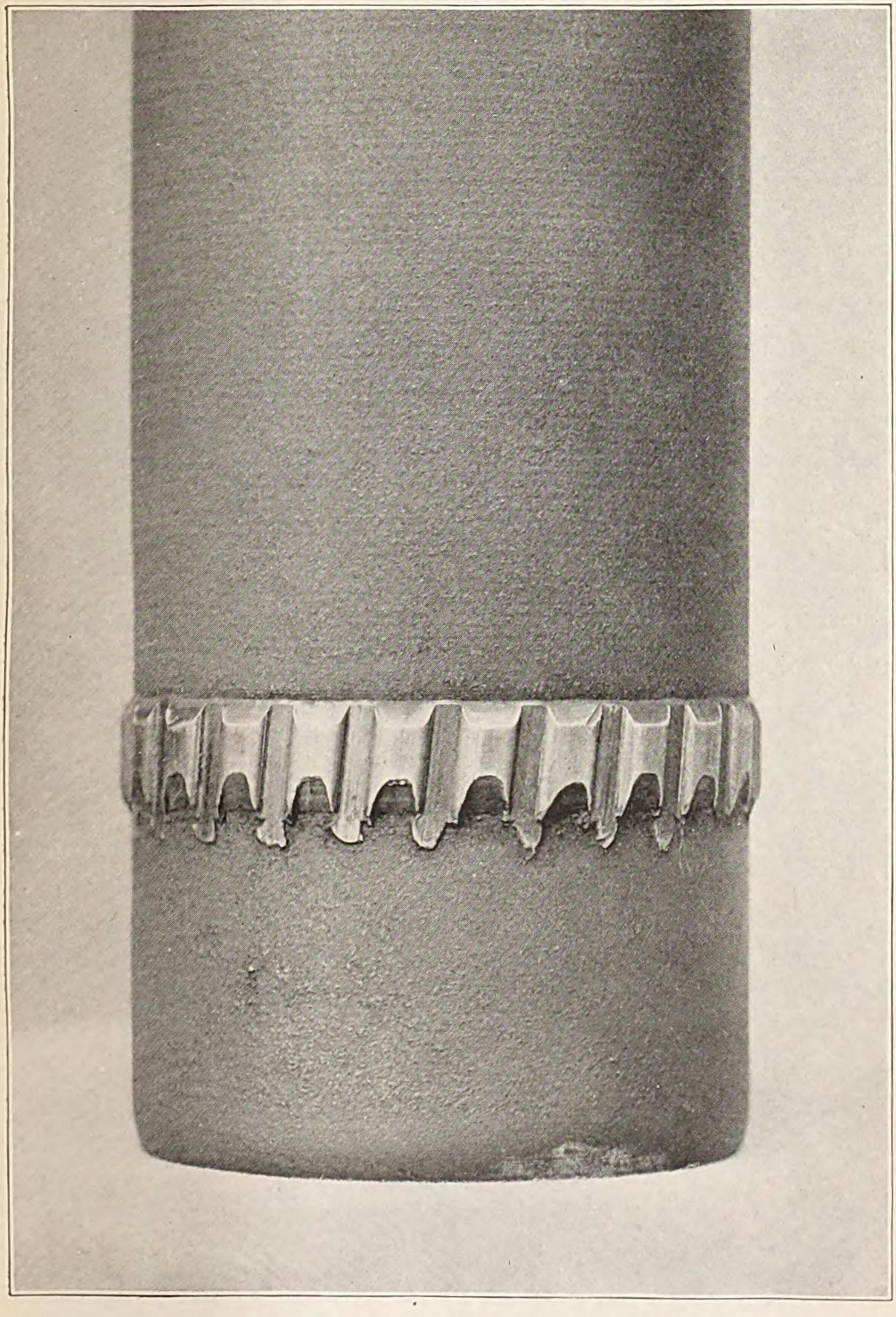
Bore not lubricated.



Band







PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

EXPERIMENT No. 8551.

No. 8551—Continued.

Resistance.	Distance shell traveled.	Velocity. per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
.....	.....	.....	4 15 10	Test resumed.
21,000	47.52	.....	.....	
15,900	48.51	.109	4 15 56	
16,300	49.51	.333	16 11	
16,900	51.51	.370	16 38	
16,100	53.51	.417	17 02	
14,300	55.51	.385	17 28	
14,400	57.51	.435	17 41	
14,600	59.51	.370	18 18	
14,700	61.51	.417	18 42	
13,300	63.51	.385	19 08	
12,900	65.51	.454	19 30	
5,000	67.51	.385	19 56	

The metal of the band flowed to the rear and was detached in part from the body of the band, flowing back in a comparatively thin film.

The forward flow under the lands did not extend beyond the forward limits of the band.

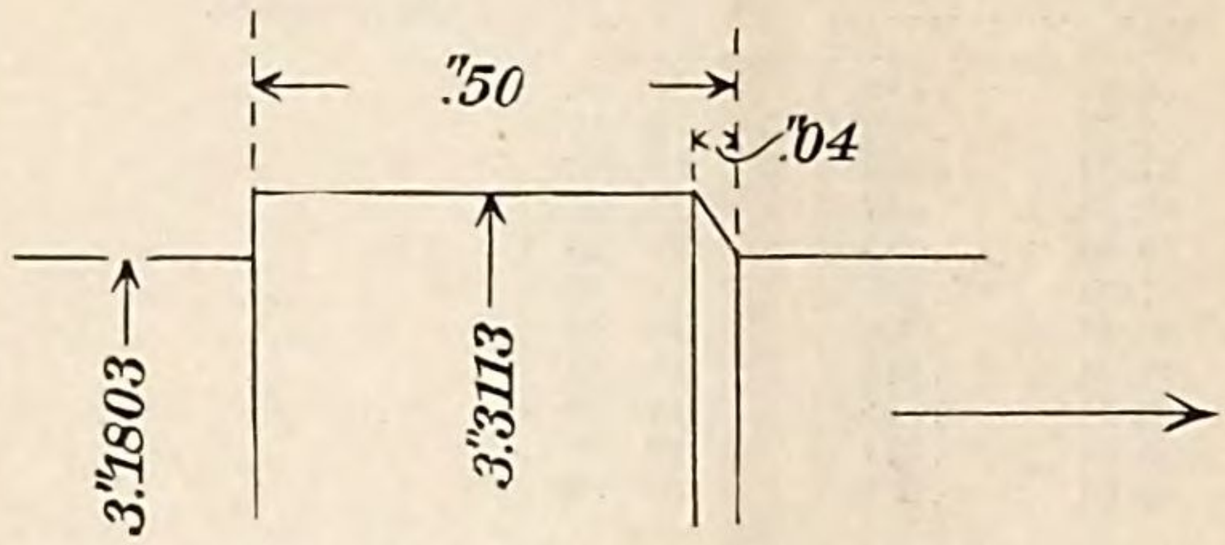
At the bottom of the grooves in the gun the bearing surface on the band was about ".24 long at the middle of each section.

No. 8552.

Bore not lubricated.

Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



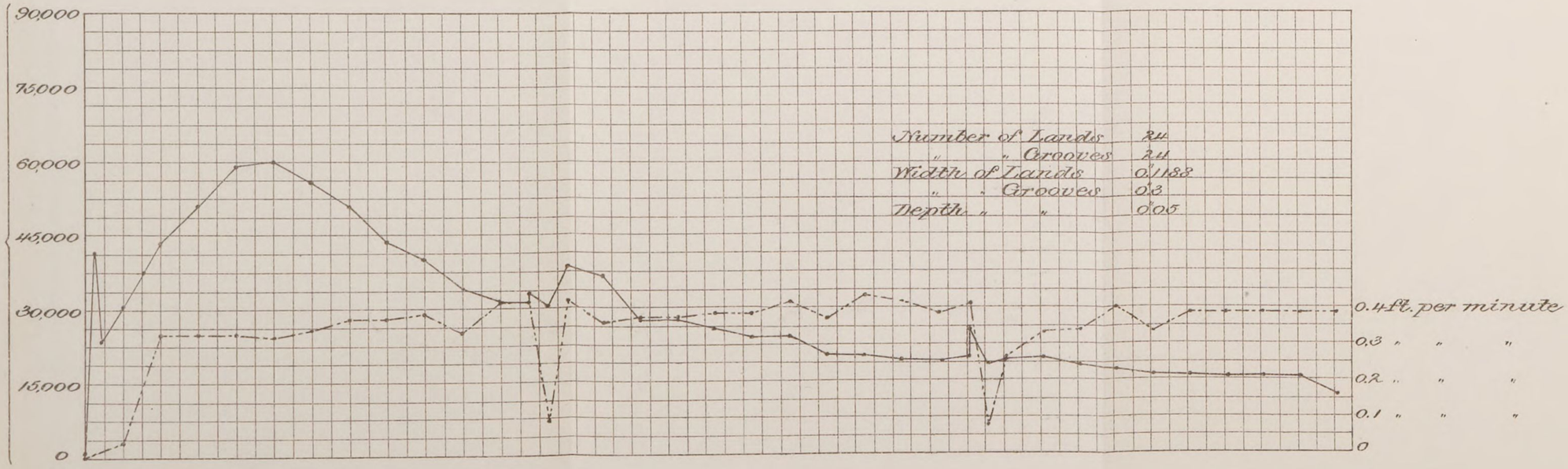
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
1,000	0.	0.	10 09 20	Initial load.
10,000	.03	----------	----------	
20,000	.07	----------	----------	
25,000	.11	.002	10 15 00	
30,000	.15	----------	----------	
35,000	.22	----------	----------	
40,000	.31	----------	----------	
41,400	.41	----------	----------	
35,000	.52	----------	----------	
27,000	.63	----------	----------	
23,500	.85	----------	----------	
30,500	2.00	.041	10 18 48	
43,200	4.00	.333	19 18	
50,100	6.00	.333	19 48	
59,100	8.00	.333	10 20 18	
60,000	10.00	.323	20 49	
55,800	12.00	.345	21 18	
51,000	14.00	.370	21 45	
43,600	16.00	.370	22 12	
40,200	18.00	.385	22 38	
34,100	20.00	.333	23 08	
31,600	22.00	.417	23 32	
31,400	23.48	.411	23 50	
				New stroke of piston.
----------	----------	----------	10 32 45	Test resumed.
33,500	23.49	----------	----------	
30,200	24.48	.094	10 33 38	
38,600	25.48	.417	33 50	
36,400	27.48	.357	34 18	
27,500	29.48	.370	34 45	
27,700	31.48	.370	35 12	
26,100	33.48	.385	35 38	
23,900	35.48	.385	36 04	
24,300	37.48	.417	36 28	
20,300	39.48	.370	36 55	
20,200	41.48	.435	37 18	
19,200	43.48	.417	37 42	
19,100	45.48	.385	38 08	
19,800	47.13	.412	38 28	
				New stroke of piston.
----------	----------	----------	11 20 55	Test resumed.
26,000	47.15	----------	----------	
18,200	48.13	.078	11 21 59	
19,300	49.13	.263	22 18	
19,700	51.13	.333	22 48	
18,200	53.13	.345	23 17	
17,300	55.13	.400	23 42	
16,200	57.13	.333	24 12	
16,000	59.13	.385	24 38	
15,800	61.13	.385	25 04	
15,800	63.13	.385	25 30	
15,700	65.13	.385	25 56	
12,400	67.13	.385	26 22	

No. 8552

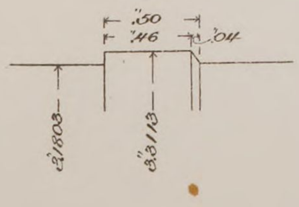
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

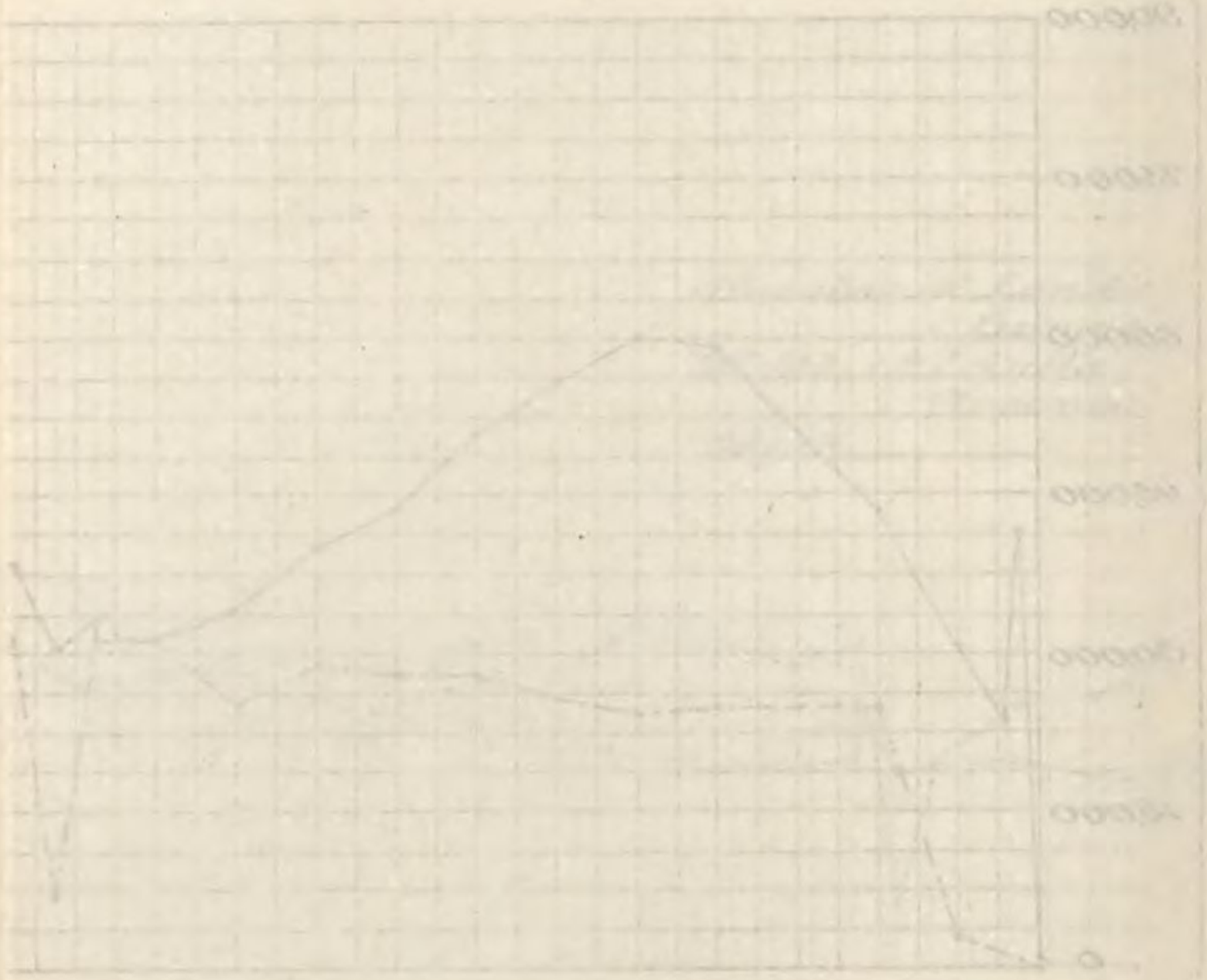
Diagram showing curves of resistance
and velocity, of banded shell when forced through the bore.

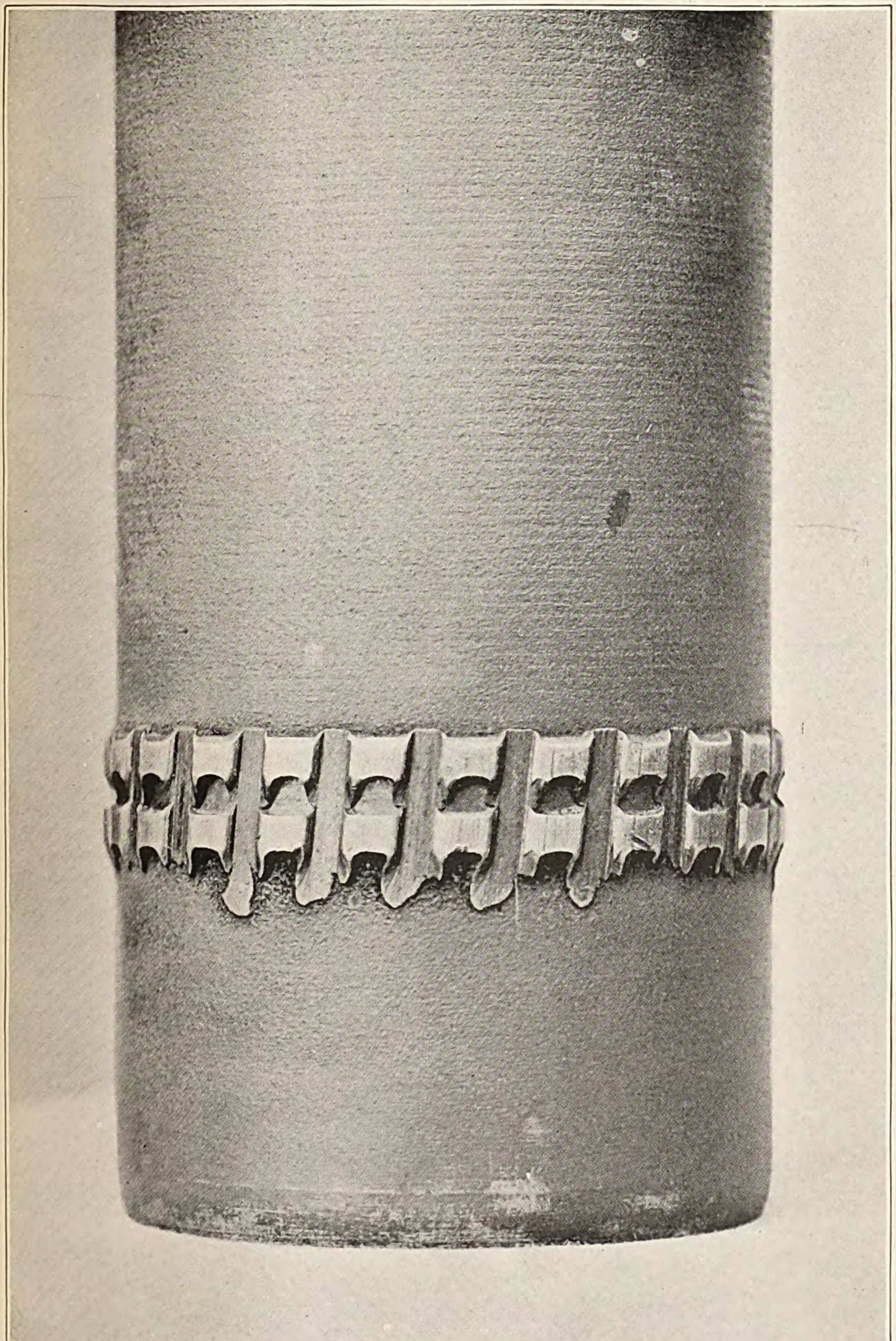
Bore not lubricated.



Band







PHOTOGRAPH OF BASE OF 3.2-INCH SHELL, SHOWING CONDITION OF COPPER BAND AFTER BEING FORCED THROUGH BORE OF RIFLE.

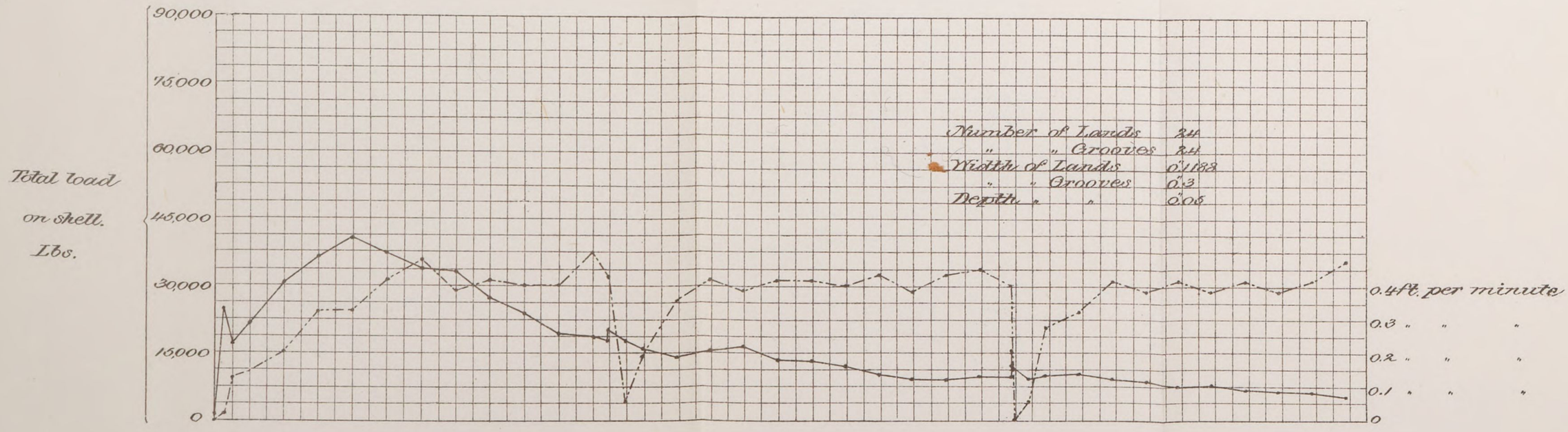
EXPERIMENT No. 8553.

No. 8553.

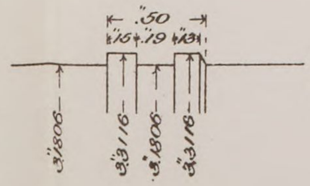
3.2-inch Driggs-Schroeder B.L. Steel Field Rifle.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

Bore not lubricated.



Band

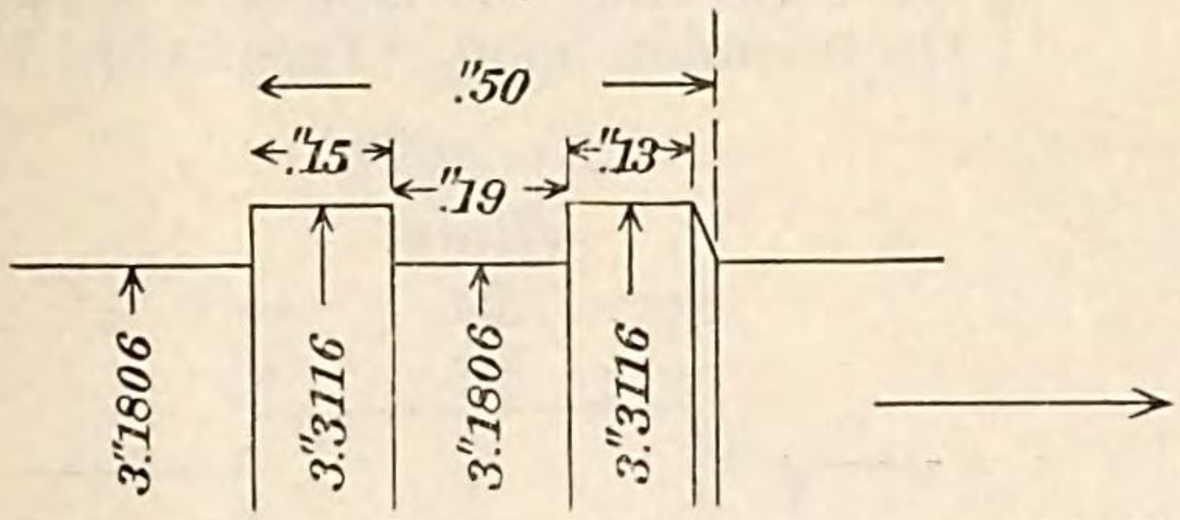


No. 8553.

Bore not lubricated.

Follower used with antifriction nut, and shell pushed through the gun.

Dimensions of band.



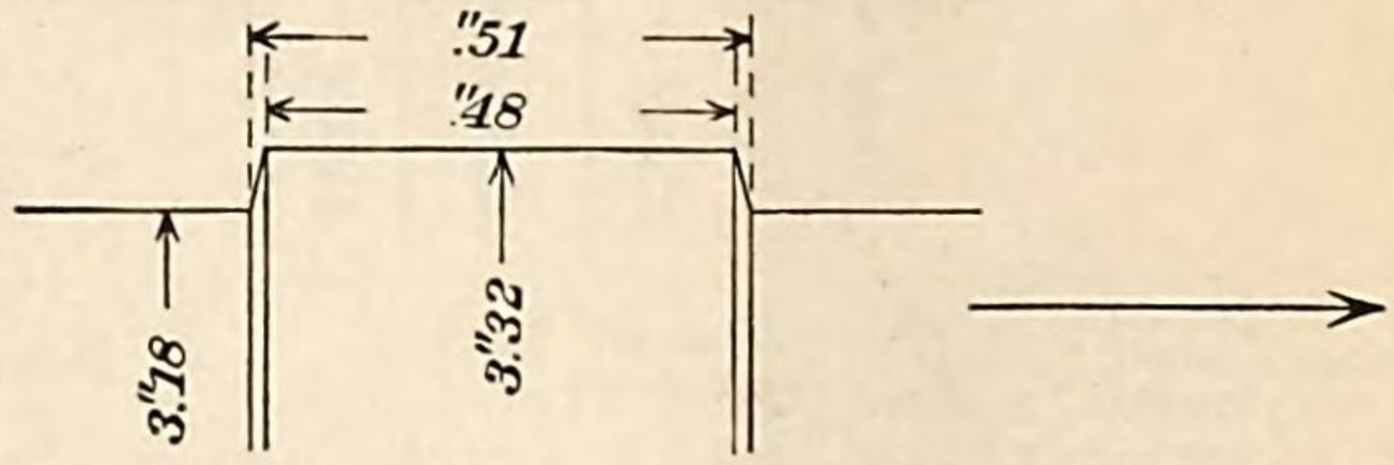
Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*foot.*	*h. m. s.*	
1,000	0.	0.	2 45 00	Initial load.
10,000	.03	.....	.....	
15,000	.07	.....	.....	
17,000	.15	.....	.....	
12,000	.32	.....	.....	
22,000	.40	.....	.....	
23,000	.42	.....	.....	
24,600	.46	.....	.....	
23,000	.53	.016	2 47 40	
20,000	.61	.....	.....	
17,100	1.00	.127	2 48 38	
21,600	2.00	.147	49 12	
30,500	4.00	.208	50 00	
36,300	6.00	.323	50 31	
40,600	8.00	.323	2 51 02	
37,200	10.00	.417	51 26	
33,700	12.00	.476	51 47	
33,300	14.00	.385	52 13	
27,200	16.00	.417	52 37	
23,800	18.00	.400	53 02	
19,100	20.00	.400	53 27	
18,800	22.00	.500	53 47	
17,700	22.95	.432	53 58	
				New stroke of piston.
.....	.....	.....	3 24 00	Test resumed.
20,100	22.96	.....	.....	
17,800	23.95	.054	3 25 32	
15,700	24.95	.192	25 58	
14,200	26.95	.357	26 26	
15,100	28.95	.417	26 50	
16,100	30.95	.385	27 16	
13,700	32.95	.417	27 40	
13,500	34.95	.417	28 04	
11,800	36.95	.400	28 29	
10,200	38.95	.435	28 52	
9,200	40.95	.385	29 18	
9,000	42.95	.435	29 41	
9,700	44.95	.400	30 06	
9,600	46.73	.405	30 28	
12,800	.....	.....	.....	Resistance when end of stroke was reached and travel of shell ceased. This higher resistance was gradually reached, and after the lapse of 3 to 4 minutes the load on the scale advanced still more, going to 14,100 pounds, all motion of the shell having ceased in the first instance. Similar phenomena have been observed in earlier tests.
				At the expiration of 20 minutes the increase in resistance had nearly ceased, the load on the scale now being 15,600 pounds. The load was now released and a new stroke of piston taken.
.....	.....	.....	3 54 00	Test resumed.
12,200	46.75	.....	.....	
9,300	47.73	.055	3 55 30	
10,200	48.73	.278	55 48	
10,500	50.73	.323	56 19	
9,200	52.73	.417	3 56 43	
8,700	54.73	.385	57 09	
7,500	56.73	.417	57 33	
7,600	58.73	.385	57 59	
6,800	60.73	.417	58 23	
6,500	62.73	.385	58 49	
6,200	64.73	.417	59 13	
5,000	66.73	.476	59 34	

3.2-INCH B. L. STEEL FIELD RIFLE. MODEL 1890.

Gun branded { At muzzle, { "No. 1 Watervliet Arsenal. 1893. 798 lbs. F. E. H." ; On trunnion, "3.2 inch model 1890." ; On trunnion hoop, "Proof Gun U. S."

No. 8628.

Band.



Bore of gun swabbed with cotton waste, which removed excess of grease used to prevent rust in shipping.

Shell pushed through the gun, using antifriction nut.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
14,000	0.	.....	8 43 40	Initial load.
20,000	.03	.....	.....	
25,000	.07	.....	.....	
30,000	.10	.....	.....	
35,000	.16	.....	.....	
40,000	.25	.....	.....	
45,000	.34	.....	.....	
45,600	.38	.....	.....	
36,000	.66	0.027	8 45 30	
36,500	1.00	.....	.....	
39,200	2.00	.223	8 46 00	
45,800	4.00	.357	8 46 28	
51,000	6.00	.370	8 46 55	
49,900	8.00	.400	8 47 20	
.....	9.33	.....	.....	Follower bar bent. Test discontinued while a new bar was prepared.
.....	.....	.....	10 43 30	Test resumed.
60,400	.....	.....	.....	Maximum resistance.
48,500	.....	.....	.....	Continues movement.
52,500	10.33	.005	10 45 20	
50,100	11.33	.167	45 50	
49,800	13.33	.357	46 18	
51,300	15.33	.270	46 55	
50,400	17.33	.400	47 20	Throbs.
45,000	19.33	.333	47 50	
39,200	21.33	.333	48 20	
36,900	23.33	.357	48 48	
34,500	25.33	.370	49 15	
32,100	27.33	.357	49 43	
30,600	29.33	.370	50 10	
30,200	31.33	.357	50 38	
29,700	32.94	.447	10 50 56	New stroke of piston.
.....	.....	.....	10 59 20	Test resumed.
36,600	.....	.....	.....	Maximum resistance.
27,300	33.94	.074	11 00 28	
27,500	34.94	.357	11 00 42	
27,900	36.94	.357	01 10	
28,100	38.94	.357	01 38	
28,800	40.94	.370	02 05	
26,100	42.94	.385	02 31	
26,100	44.94	.400	02 56	
24,600	46.94	.385	03 22	
24,200	48.94	.385	03 48	
24,100	50.94	.385	04 14	
23,200	52.94	.385	04 40	
23,200	54.94	.323	05 11	
22,000	56.63	.352	11 05 35	End of stroke.
27,600	.....	.....	.....	Resistance rose to this load as piston ceased to move. New stroke of piston.

No. 8628.

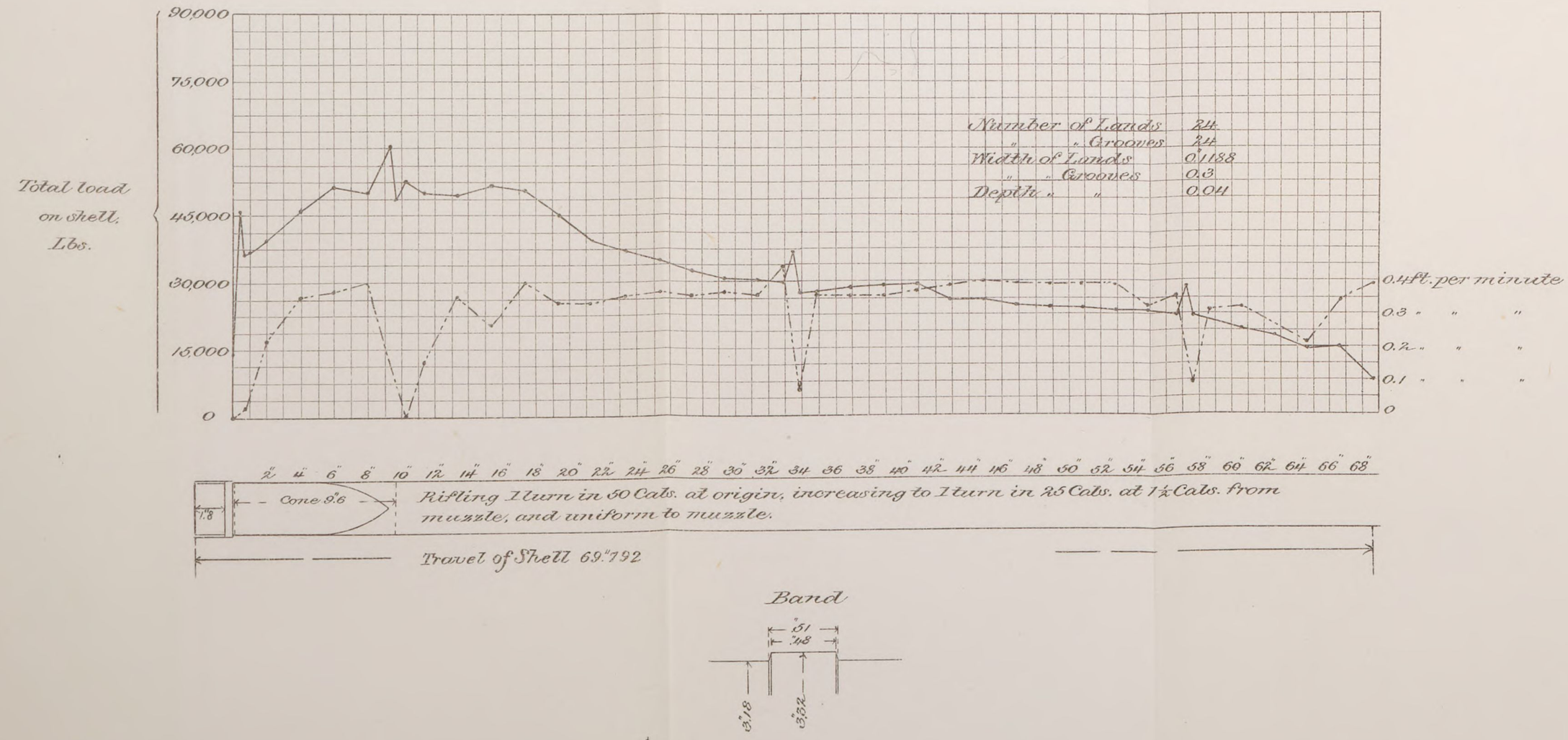
3.2 inch B.L. Steel Field Rifle.

Model 1890.

Diagram showing curves of resistance,

and velocity, of banded shell when forced through the bore.

Bore lubricated.



Band

No. 8628—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
.....	.....	.....	11 13 40	Test resumed.
28,800	.....	.....	.....	Maximum resistance.
21,700	57.63	.094	11 14 33	
20,900	58.63	.312	14 49	
19,000	60.63	.323	15 20	
				Test interrupted.
17,800	62.63	.....	11 20 00	
14,800	64.63	.217	20 46	
15,100	66.63	.345	21 15	
7,600	67,63	.385	11 21 28	

Hardly any trace of lubricant in front of the band when the shell came from the gun.

No. 8629.

Same gun as in experiment No. 8628, and shell and band of same dimensions.

Shell pushed through the gun, antifriction nut used.

Bore not lubricated.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	0.	.....	1 20 10	Initial load.
10,000	.02	.....	.....	
20,000	.08	.....	.....	
25,000	.13	.....	.....	
30,000	.21	.....	.....	
35,000	.35	.....	.....	
37,100	.40	.....	.....	
35,000	.47	.....	.....	
33,000	.53	.....	.....	
30,000	.62	.....	1 26 25	
28,000	.73	.....	26 55	
28,100	1.00	0.067	27 15	Speed of piston increased.
34,300	2.00	.143	27 50	
39,600	4.00	.250	28 30	
44,800	6.00	.263	29 08	
42,800	8.00	.312	29 40	
44,300	10.00	.357	30 08	
41,200	12.00	.370	30 35	
41,000	14.00	.370	1 31 02	
38,600	16.00	.370	31 29	
38,000	18.00	.385	31 55	
33,700	20.00	.400	32 20	
27,700	22.00	.357	32 48	
27,000	23.78	.371	33 12	Stroke of piston exhausted.
29,900	.....	.....	.....	Resistance increased to this load as piston ceased to move.
				New stroke of piston.
.....	.....	.....	1 42 40	Test resumed.
33,100	.....	.....	.....	Maximum resistance.
25,900	24.78	.069	1 43 52	
25,900	25.78	.312	44 08	
24,100	27.78	.312	44 40	
24,100	29.78	.400	45 05	
25,200	31.78	.370	45 32	
23,300	33.78	.417	45 56	
22,900	35.78	.400	46 21	
23,100	37.78	.400	46 46	
23,500	39.78	.357	47 14	
23,300	41.78	.323	47 45	
21,500	43.78	.345	48 14	
22,500	45.78	.500	48 34	
22,200	47.56	.404	48 56	Stroke of piston exhausted.
23,800	.....	.....	.....	Resistance increased to this load.
				New stroke of piston.
.....	.....	.....	1 56 06	Test resumed.
27,200	.....	.....	.....	Maximum resistance.
22,800	48.56	.072	1 57 15	
21,900	49.56	.333	57 30	
22,400	51.56	.400	57 55	
22,600	53,56	.435	58 18	
23,700	55.56	.400	58 43	
23,600	57.56	.400	59 08	
21,200	59.56	.385	59 34	
21,000	61.56	.417	59 58	
18,000	63.56	.294	2 00 32	
18,400	65.56	.417	00 56	
15,200	67.56	.417	01 20	

No. 8629.

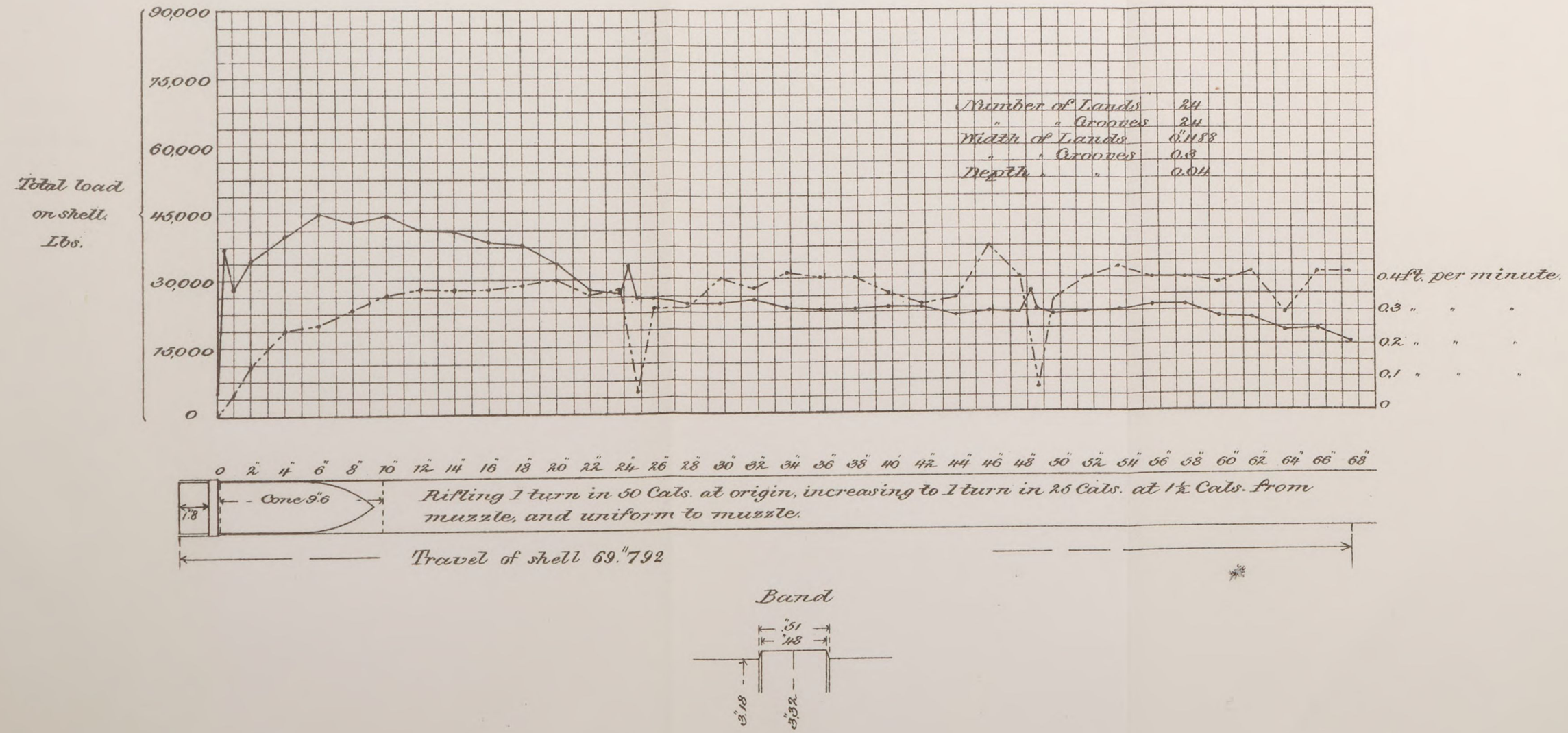
3.2-inch B.L. Steel Field Rifle.

Model 1890.

Diagram showing curves of resistance,

and velocity, of banded shell when forced through the bore.

Bore not lubricated.



Band

No. 8369.

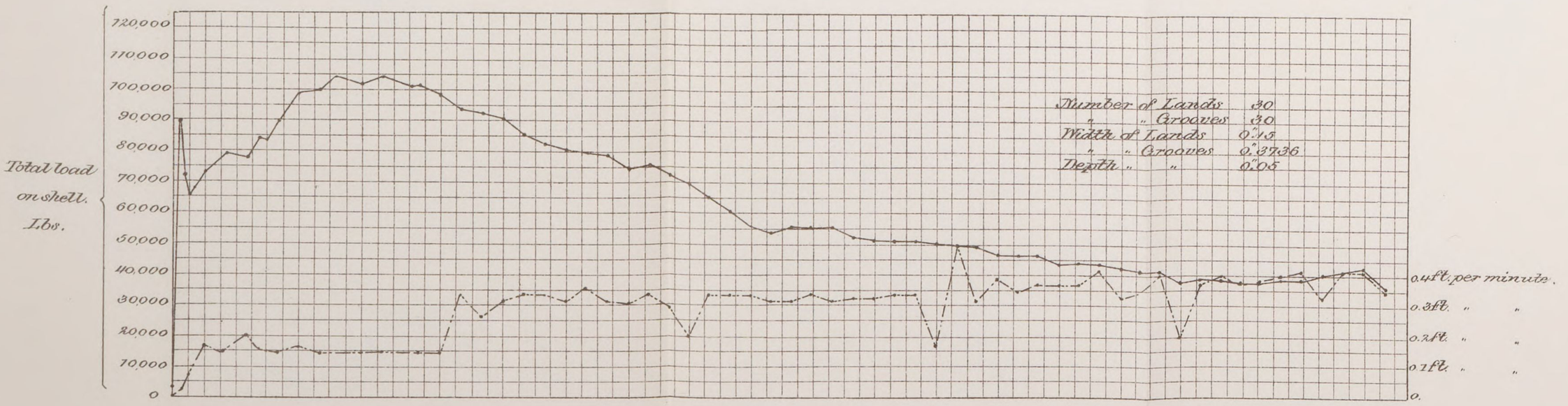
5-inch B.L. Steel Siege Rifle.

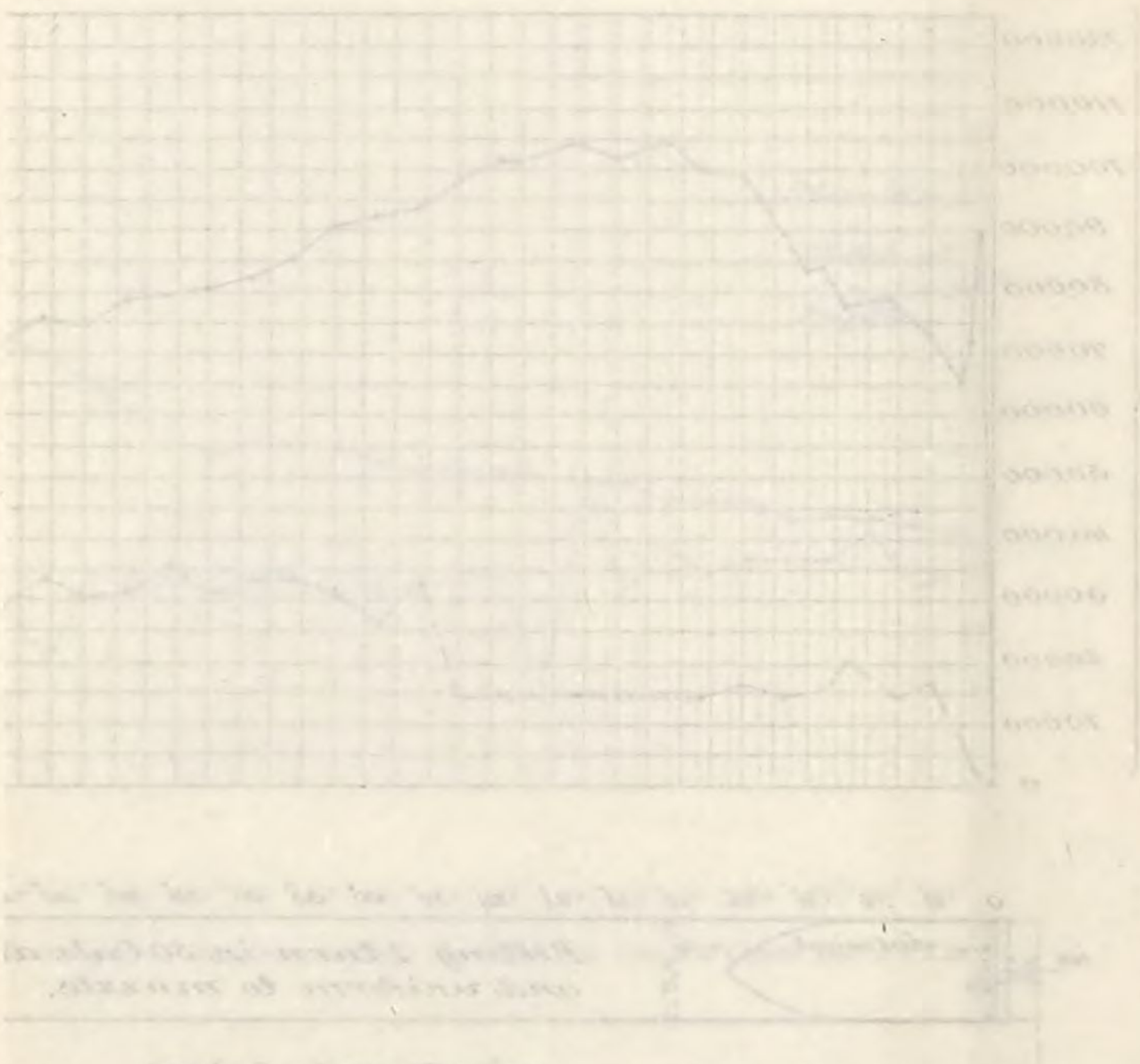
Model 1890.

Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

1st experiment.

Bore not lubricated.

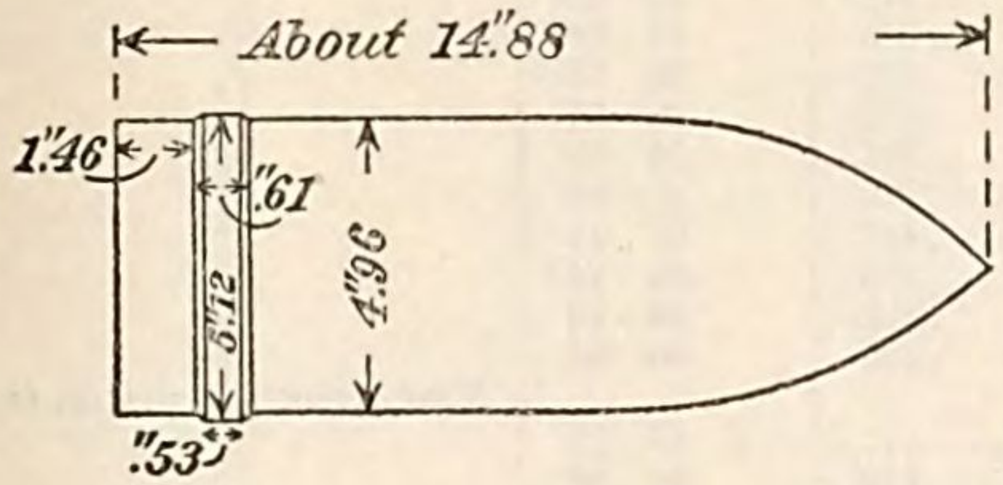




5-INCH B. L. STEEL SIEGE RIFLE.

No. 8369.

Marks on rifle:
"Model 1890" on trunnion.
"5-in., No. 1, Wt. 3,630 lbs. F. E. H., Insp. Watervliet Arsenal, 1893," } on muzzle.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	0.	0.	3 09 00	Initial load.
30,000	.13	.....	.....	
50,000	.23	.....	.....	
60,000	.30	.....	.....	
70,000	.35	.....	.....	
80,000	.41	.....	3 11 00	
89,000	.58	.....	11 30	
82,000	.76	.....	.....	
72,000	1.00	.026	3 12 10	
65,000	1.50	.071	12 45	
73,000	3.00	.167	3 13 30	
79,700	5.00	.143	14 40	
77,700	7.00	.200	15 30	
84,000	8.25	.156	16 10	
83,100	9.00	.....	16 40	
89,600	10.00	.146	17 10	
98,800	12.00	.167	18 10	
99,900	14.00	.143	19 20	
104,200	15.50	.....	.....	
102,100	16.00	.143	3 20 30	
102,000	18.00	.143	21 40	
104,300	20.00	.147	22 48	
101,100	22.00	.143	23 58	
101,600	22.50	.144	24 50	
				New stroke of piston taken.
99,000	23.50	.....	3 34 00	
98,200	25.50	.143	35 10	
93,300	27.50	.333	35 40	
92,700	29.50	.263	36 18	
90,500	31.50	.312	36 50	
85,300	33.50	.333	37 20	
82,700	35.50	.333	37 50	
80,600	37.50	.312	38 22	
79,700	39.50	.357	38 50	
78,200	41.50	.312	39 22	
74,300	43.50	.303	39 55	
75,700	45.50	.333	3 40 25	
72,300	47.50	.286	41 00	
				New stroke of piston taken.
70,000	47.50	.....	3 49 00	
69,600	49.50	.200	49 50	
65,000	51.50	.333	50 20	
60,100	53.50	.333	50 50	
55,200	55.50	.333	51 20	
53,700	57.50	.312	51 52	
55,300	59.50	.312	52 24	
55,000	61.50	.333	52 54	
55,200	63.50	.312	53 26	
52,800	65.50	.323	53 57	
51,800	67.50	.323	54 28	
51,300	69.50	.333	54 58	
51,300	71.50	.333	55 28	
				New stroke of piston taken.

No. 8369—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
49,000	71.50	.....	4 03 10	
50,200	73.50	0.167	04 10	
49,900	75.50	.500	04 30	
48,600	77.50	.312	05 02	
46,800	79.50	.385	05 28	
46,500	81.50	.345	05 57	
46,600	83.50	.370	06 24	
43,600	85.50	.370	06 52	
44,100	87.50	.370	07 19	
43,700	89.50	.417	07 43	
42,200	91.50	.323	08 14	
41,100	93.50	.345	08 43	
41,100	95.50	.400	09 08	
				New stroke of piston taken.
39,000	95.50	.....	4 43 10	
37,900	97.50	.200	44 00	
38,800	99.50	.370	44 27	
38,400	101.50	.400	44 52	
37,700	103.50	.370	45 19	
37,900	105.50	.385	45 45	
38,600	107.50	.400	46 10	
38,100	109.50	.417	46 34	
40,300	111.50	.323	47 05	
41,300	113.50	.417	47 29	
42,500	115.50	.417	47 53	
36,000	117.50	.345	4 48 22	Test completed.

Opposite the lands the copper in the band was forced to the rear about ″.47 and opposite the grooves about ″.09, the total length at these two parts being 1″.08 and ″.70, respectively.

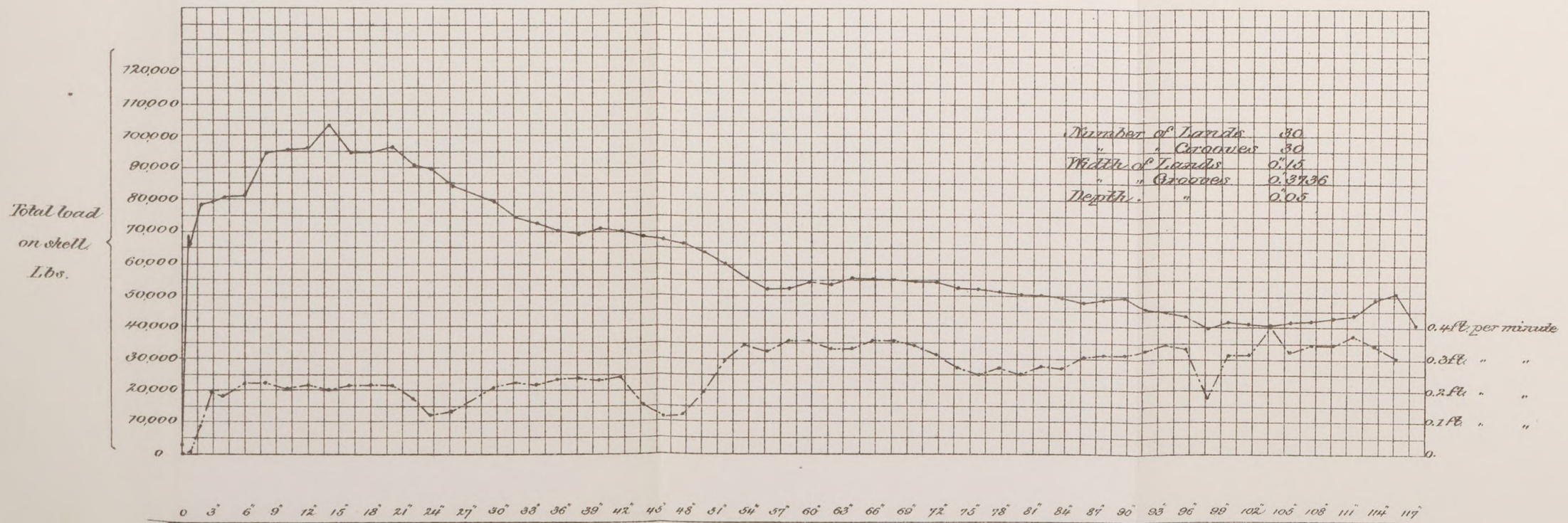
No. 8370.

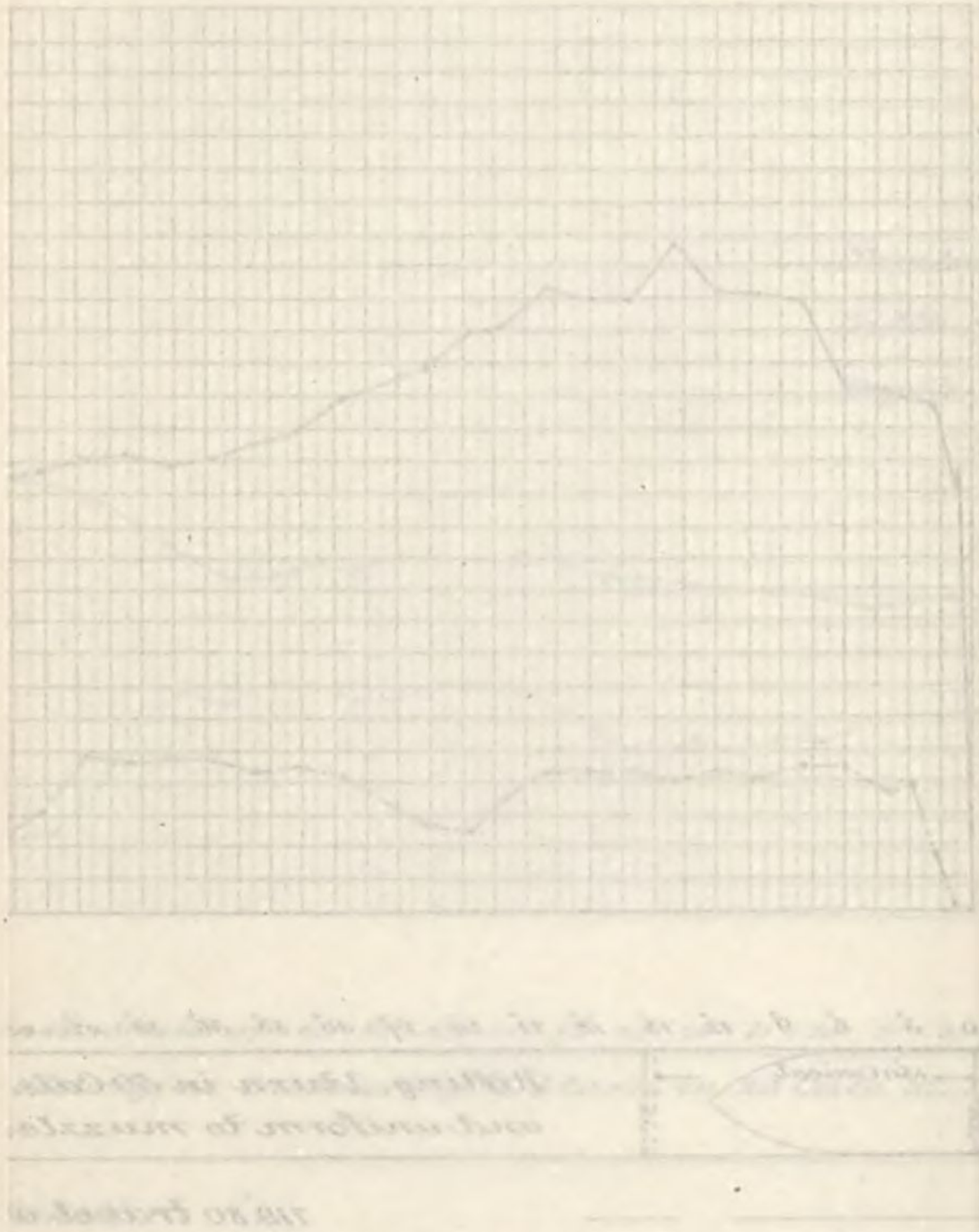
5-inch B.L. Steel Siege Rifle.
Model 1890.

Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

2nd. experiment.

Bore not lubricated.





No. 8370.

Shell rebanded and again forced through the rifle.
Dimensions of band same as in preceding test.

NOTE.—There was a slight deficiency of metal in the band; hence it did not turn up to full exterior diameter at all parts of the circumference.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	0.	.....	8 43 30	Initial load.
10,000	.02	.....	.....	
20,000	.07	.....	.....	
30,000	.15	.....	8 45 00	
35,000	.17	.....	.....	
40,000	.20	.....	.....	
45,000	.23	.....	.....	
50,000	.27	.....	.....	
55,000	.33	.....	.....	
60,000	.37	.....	8 47 30	
65,000	.43	.....	.....	
68,500	.55	.....	.....	
66,000	.65	0.010	8 49 00	
78,500	1.72	.089	50 00	
79,400	2.90	.197	50 30	
80,800	4.00	.183	51 00	
81,000	6.00	.222	51 45	
94,500	8.00	.222	8 52 30	
95,400	10.00	.204	53 19	
96,000	12.00	.213	54 06	
103,300	14.00	.200	54 56	
94,300	16.00	.217	55 42	
94,500	18.00	.217	56 28	
96,500	20.00	.213	57 15	
90,500	22.00	.175	58 12	
89,400	23.70	.118	59 24	
				New stroke of piston taken.
76,000	23.80	.....	9 17 00	
83,900	25.70	.128	18 14	
79,100	29.70	.208	19 50	
74,700	31.70	.222	20 35	
72,600	33.70	.217	21 21	
70,600	35.70	.233	22 04	
69,600	37.70	.238	22 46	
71,100	39.70	.233	23 29	
70,200	41.70	.244	24 10	
68,000	43.70	.154	25 15	
67,600	45.70	.119	26 39	
66,700	47.70	.123	28 00	
				New stroke of piston taken.
64,000	47.80	.....	9 37 00	
64,000	49.70	.198	37 48	
60,100	51.70	.294	38 22	
55,800	53.70	.345	9 38 51	
52,200	55.70	.323	39 22	
52,300	57.70	.357	39 50	
54,200	59.70	.357	40 18	
53,600	61.70	.333	40 48	
55,700	63.70	.333	41 18	
55,100	65.70	.357	41 46	
55,000	67.70	.357	41 14	
54,600	69.70	.345	41 43	
54,200	71.70	.312	42 15	
				New stroke of piston taken.
51,400	71.80	.....	9 55 00	
52,500	73.70	.271	9 55 35	
52,400	75.70	.250	56 15	
51,100	77.70	.270	56 52	
50,600	79.70	.250	57 32	
50,300	81.70	.278	58 08	
49,200	83.70	.270	58 45	
47,400	85.70	.303	59 18	
48,500	87.70	.312	59 50	
49,200	89.70	.312	10 00 22	
45,300	91.70	.323	00 53	
44,300	93.70	.345	01 22	
43,000	95.58	.336	01 50	
				New stroke of piston taken.

No. 8370—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m, s.*	
40,200	95.68	.....	10 26 00	
39,500	97.58	.176	26 54	
41,300	99.58	.312	10 27 26	
41,000	101.58	.312	27 58	
40,200	103.58	.400	28 23	
41,300	105.58	.323	28 54	
41,400	107.58	.345	29 23	
42,800	109.58	.345	29 52	
43,500	111.58	.370	30 19	
48,400	113.58	.345	30 48	
51,100	115.58	.303	10 31 21	
41,000	117.58	.....	.....	Test completed.

Opposite the lands the copper band was ″.98 long and opposite the grooves ″.66 long after the test.

Of the total ″.98 opposite the lands, about ″.05 represents the flow of the band in a forward direction; hence the amount of flow toward the rear at this place was ″.98—(″.05 + ″.61) = ″.32.

Opposite the grooves there was hardly any perceptible forward flow of the copper.

No 8357.

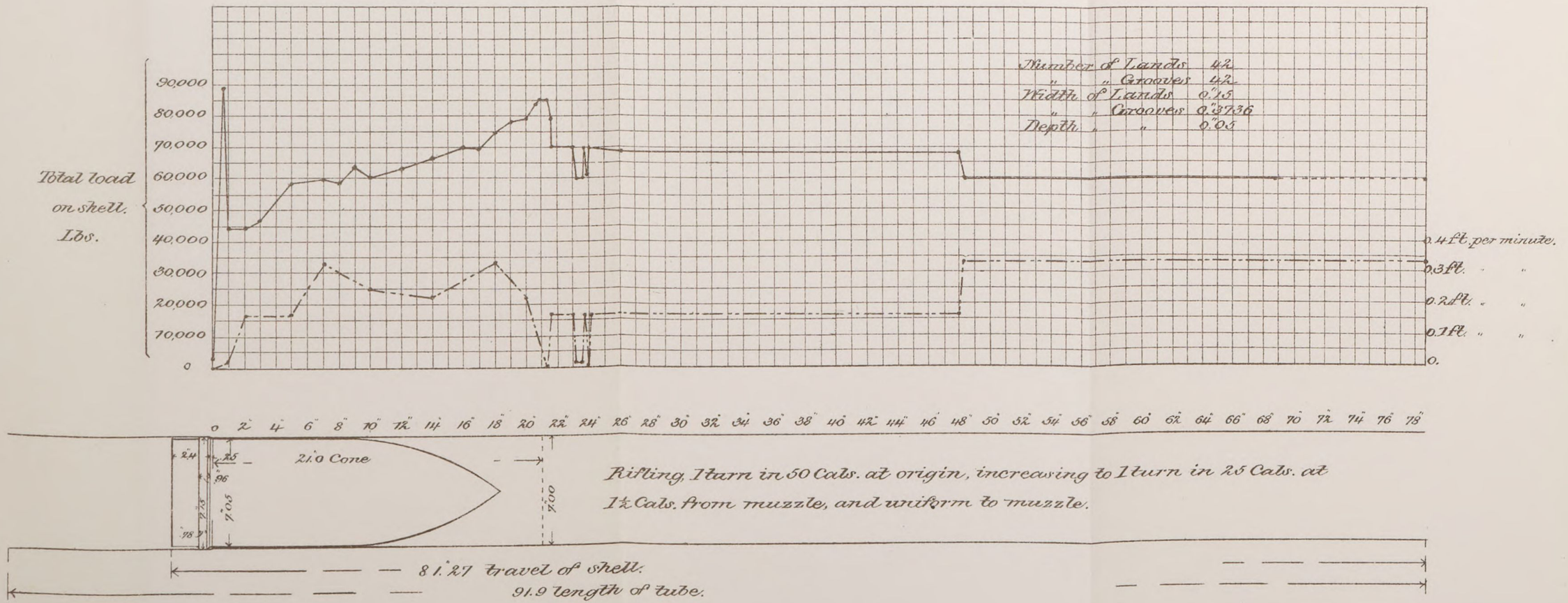
7-inch B.L. Steel Siege Howitzer.

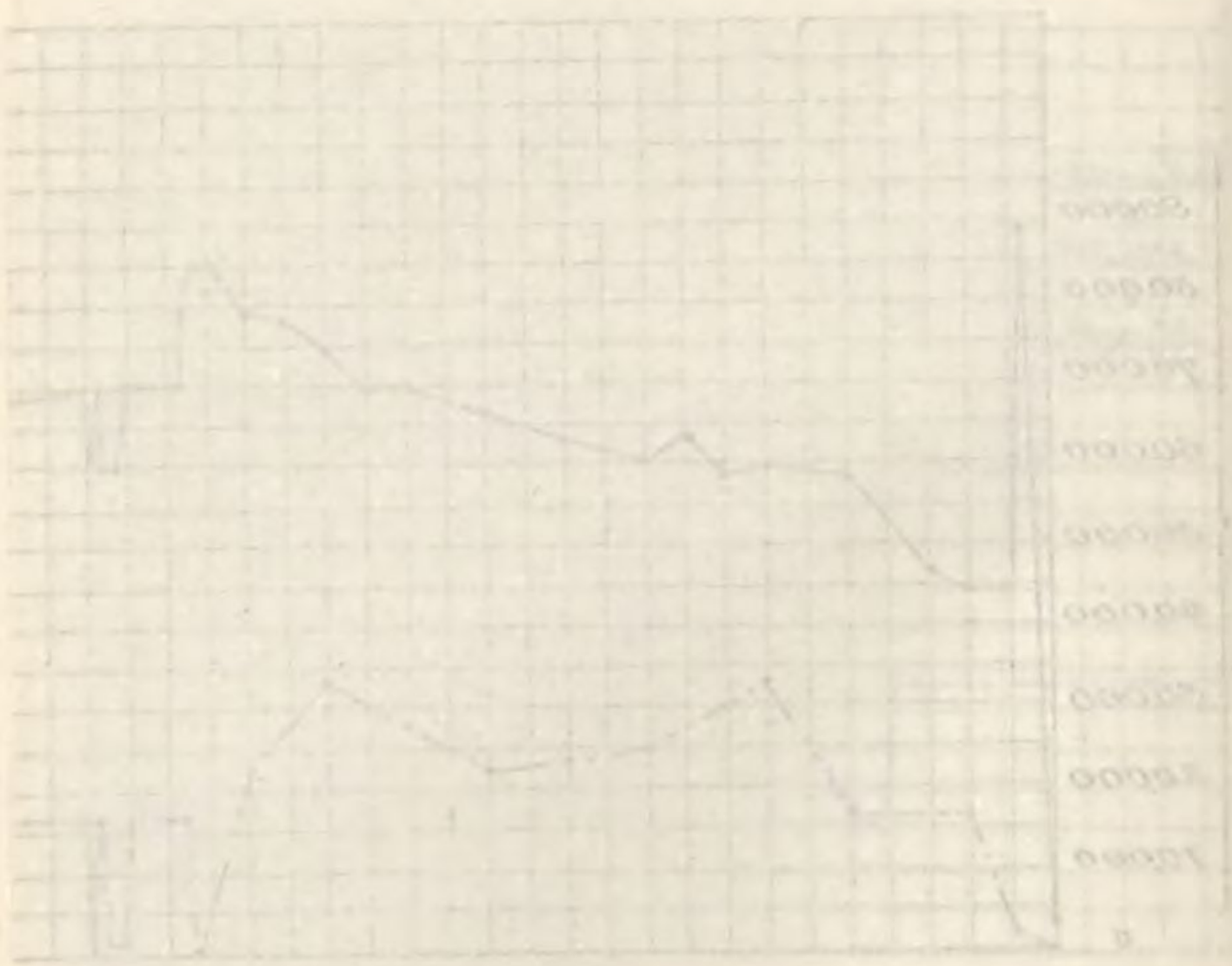
Model 1890.

Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

1st. experiment.

Bore not lubricated

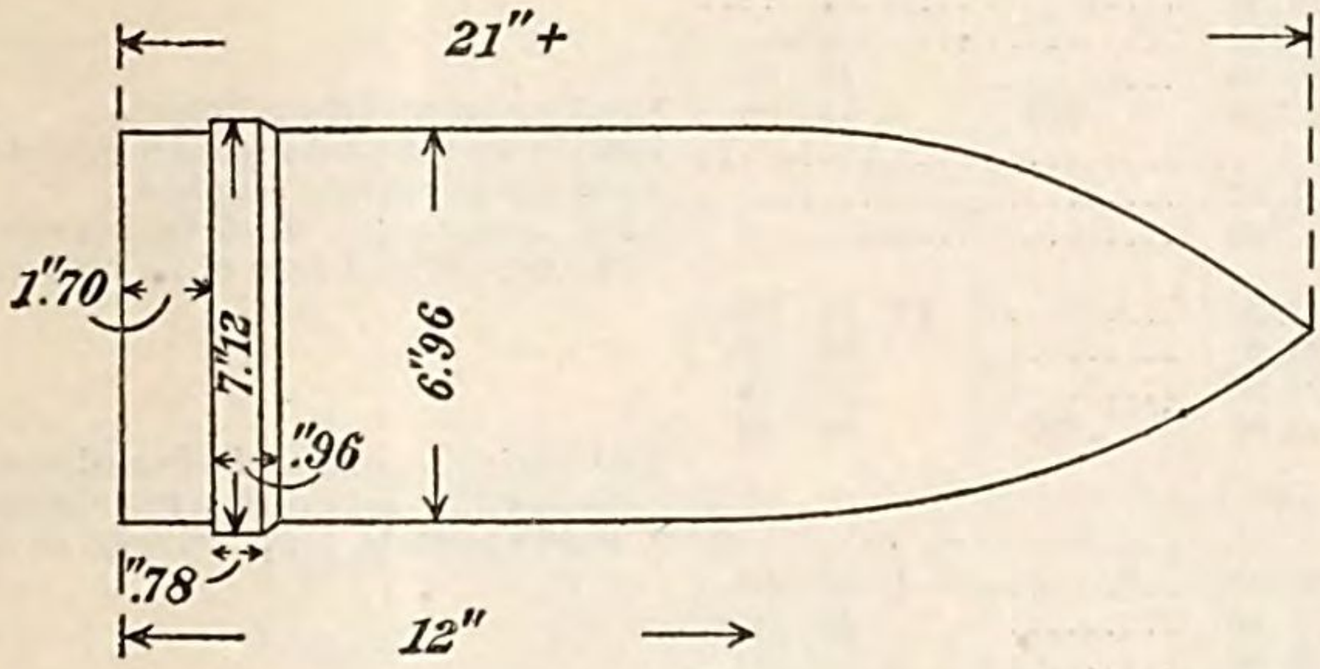




7-INCH B. L. STEEL SIEGE HOWITZER.

No. 8357.

Marks on gun:
"Model 1890" on trunnion.
"7-in No. 5 Wt. 3710 lbs. W. S. P. Insp. Watervliet Arsenal 1893" } on muzzle.



Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
2,500	0.	0.	11 39 00	Initial load.
32,000	.05	.....	40 00	
36,000	.10	.....	40 30	
44,000	.20	.....	.....	
57,000	.34	.....	41 00	
76,800	.50	.....	42 00	
88,600	.70	.....	.....	
71,000	.80	.....	43 00	
56,000	.90	.....	.....	
44,000	1.00	.017	44 00	
44,000	2.00	.167	44 30	Rapid rate.
46,500	3.00	.167	11 45 00	
55,100	4.00	.....	.....	
58,700	5.00	.167	46 00	
59,800	6.00	.....	.....	
59,700	7.00	.333	46 30	
58,600	8.00	.....	.....	
63,400	9.00	.....	.....	
60,200	10.00	.250	47 30	
61,600	11.00	.....	.....	
63,000	12.00	.....	.....	
64,800	13.00	.....	.....	
66,400	14.00	.222	49 00	
69,100	15.00	.....	.....	
69,800	16.00	.....	.....	
69,700	17.00	.....	.....	
74,400	18.00	.333	50 00	
77,500	19.00	.....	.....	
78,400	20.00	.222	50 45	
53,000	20.07	.....	53 00	Piston stationary 2¼ minutes.
63,600	20.08	.....	.....	
63,900	20.09	.....	.....	
63,800	20.10	.....	.....	
63,400	20.15	.....	55 30	
63,300	20.16	.....	56 00	
81,000	20.40	.....	.....	Load momentarily reached.
53,300	20.42	.....	59 20	
83,300	20.62	.....	.....	Load momentarily reached.
53,200	20.62+	.004	12 03 00	
85,000	20.86	.....	.....	Load momentarily reached. Rested 40 minutes; the load in the meantime fell to 43,200 pounds.

No. 8357—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
43,200	20.86	.....	12 42 00	
66,700	20.87	.....	45 00	
66,600	20.88	.....	.....	
66,600	20.89	.....	.....	
64,900	20.90	.....	.....	
65,200	20.91	.....	46 00	
65,300	20.92	.....	.....	
65,300	20.93	.....	.....	
65,300	20.94	.....	.....	
65,300	20.95	.....	47 00	
85,000	21.30	.001	48 00	Load momentarily reached.
4,000	.....	.....	.....	Load released and rested 3 minutes.
78,800	21.62	.....	.....	Load momentarily reached.
70,000	23.00	.....	.....	Load maintained uniform between 21″.65 and 23″.00. Rapid rate of movement of shell.
60,000	23.20	.....	12 54 00	
60,000	23.40	.....	56 30	
60,000	23.50	.....	57 15	
60,000	23.60	.007	58 30	
				The variation in speed of shell was intentionally arranged to maintain a resistance of 70,000 and 60,000 pounds, respectively, as shown above.
37,000	23.65	.....	2 45 00	
50.000	23.66	.....	47 00	
62,800	23.68	.....	49 00	
61,000	23.70	.....	49 30	
61,000	23.76	.....	.....	
				Accelerating the speed increased the resistance to 70,000 pounds. Speed then again reduced until the resistance was 61,000 pounds.
61,000	23.92	.....	2 58 19	
70,000	24.00	.....	.....	
68,000	25.64	.167	.....	Resistance 68,000 pounds while the shell traveled from 24″ to 25″.64, the interval of time being about 40 seconds.
63,000	.....	.....	.....	Rate of travel of shell 2″ per minute; continued at this speed up to the end of the stroke of the testing machine, 24″.

Another stroke of the piston taken, and run at speed of 4″ per minute, the resistance now averaging 60,000 pounds; at times reaching 63,000 pounds, and at other times falling to 57,000 pounds.

During the last 10″ of the travel of the shell in the gun the resistance increased and reached a maximum of 90,000 pounds, attributed to the rear end of the shell cramping in the bore. There were fluctuations in the resistance during this stage.

There was some abrasion of the copper band, but the principal effect was a flow of the metal under the lands of the gun, which forced the copper toward the base of the shell about ″.20 at each land.

No. 8358.

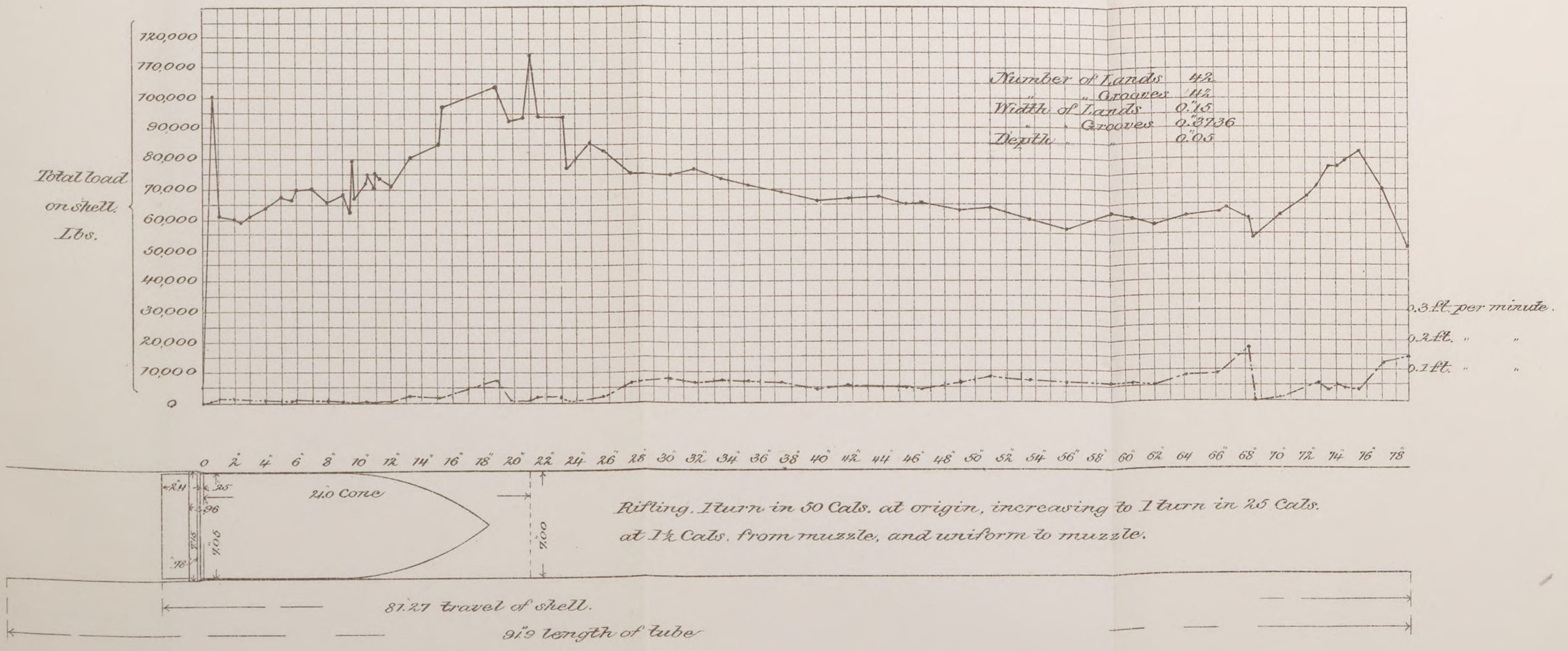
7-inch B.L. Steel Siege Howitzer.

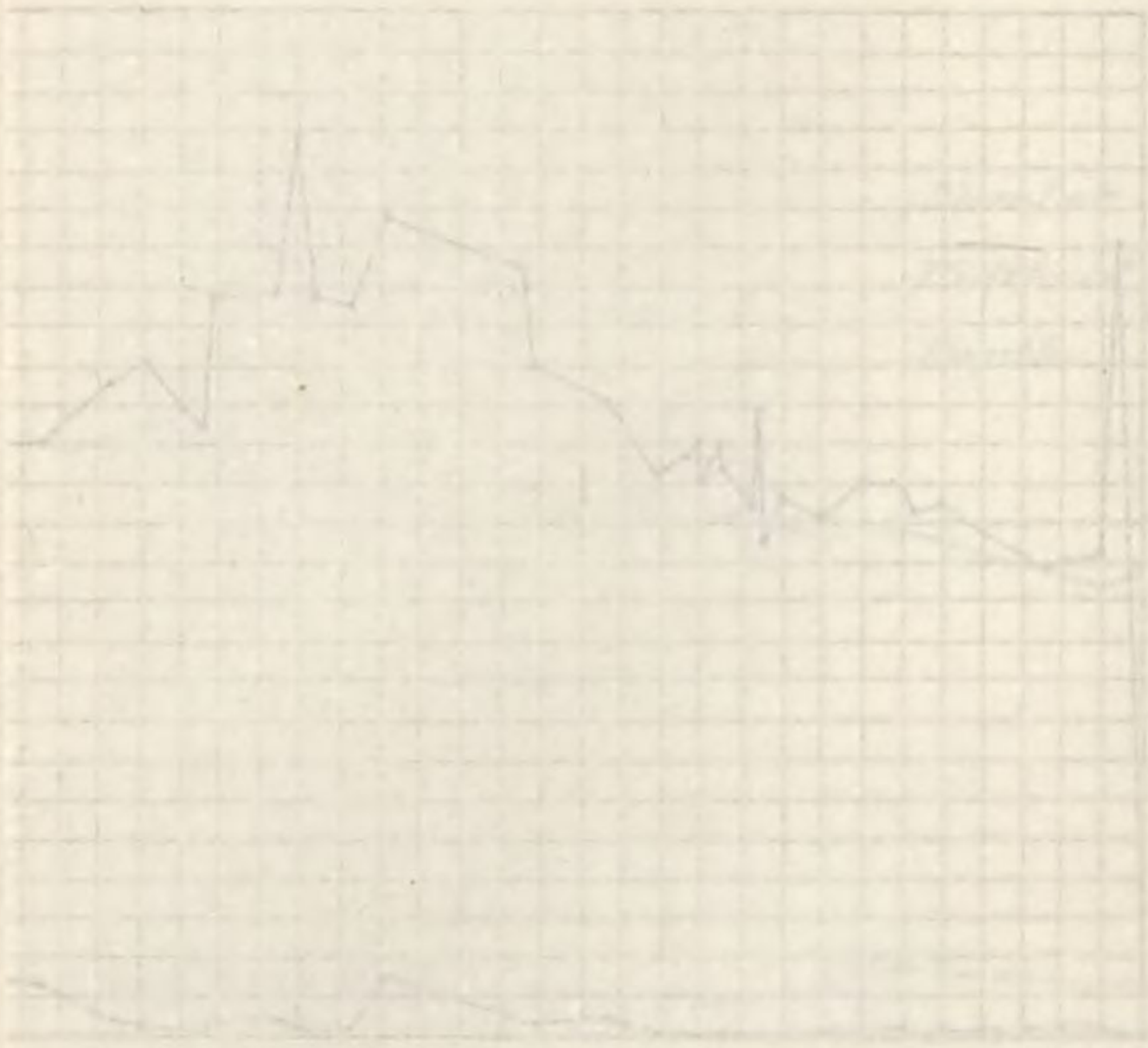
Model 1890.

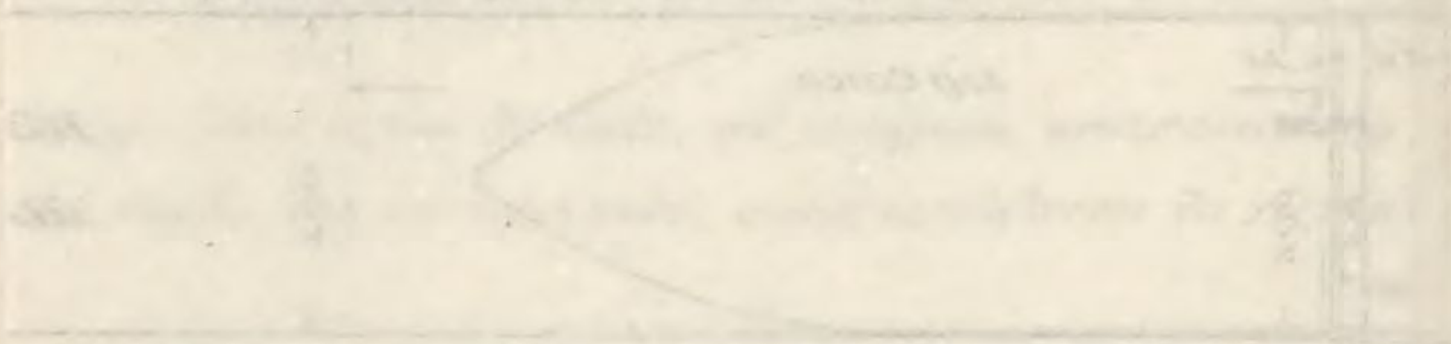
Diagram showing curves of resistance,
and velocity, of banded shell when forced through the bore.

2nd. experiment.

Bore not lubricated







No. 8358.

[Second experiment.]

Shell rebanded and again forced through gun.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	0.	0.	2 08 00	Initial load.
44,500	.05	.....	09 00	
61,400	.10	.....	10 00	
76,200	.20	.....	11 25	
83,100	.30	.....	12 10	
88,800	.40	.....	12 40	
94,100	.50	.008	13 15	
99,900	.60	.....	13 50	
97,200	.70	.....	14 30	
91,100	.75	.....	14 45	
82,800	.80	.....	15 00	
67,200	.90	.....	15 30	
61,300	1.00	.016	15 55	
59,000	1.10	.....	.....	
59,400	1.20	.....	16 50	
60,500	1.70	.....	19 25	
60,600	2.00	.017	20 45	
58,900	2.5	.....	23 35	
61,200	3.0	.....	26 40	
63,700	3.5	.....	30 10	
64,300	4.0	.012	34 00	
66,400	4.5	.....	2 38 23	
67,300	5.0	.....	43 29	
67,000	5.5	.....	49 44	
66,900	5.71	.008	52 40	Rate increased here.
69,700	5.80	.....	53 45	
70,000	6.00	.010	55 05	
70,300	6.50	.....	59 40	
71,600	6.60	.....	3 00 30	
70,300	7.00	.010	03 40	
69,400	7.50	.....	08 07	
66,000	8.00	.009	12 56	
66,300	8.50	.006	19 29 24 40	
68,500	9.00	.....	30 55	
68,100	9.50	.....	39 00	
5,000	.....	.....	.....	Load released to initial load while accumulator weights were pumped up.
5,000	9.49	.0001	3 48 30	Readings taken during one setting of testing-machine valves.
30,500	9.50		49 40	
53,200	9.51		51 50	
61,900	.....		.....	
61,400	9.52		4 03 30	
62,400	9.53		14 15	
62,600	.....	.....	.....	Valves closed, with pressure left on shell.
60,600	.....	.....	4 26 30	
60,100	.....	.....	4 35 30	Temperature of testing room about 68° F. Test discontinued.
15,700	9.50+	.....	.....	Load found on shell after about 39½ hours' rest. The temperature of the testing room was then 48° F., but during the interval of rest had been lower. The reduction in load attributed largely to fall in temperature in the testing room, diminishing the volume of oil in straining cylinder.
15,700	.....	.....	8 00 00	Valves of testing machine remain at one setting.
20,000	.....	.....	00 10	
25,000	.....	.....	00 32	
30,000	.....	.....	00 56	
35,000	.....	.....	8 01 20	
40,000	9.52	.....	01 43	
45,000	.....	.....	02 3	
50,000	.....	.....	02 23	
55,000	.....	.....	02 43	
60,000	.....	.....	8 03 04	
65,000	.....	.....	03 28	
68,000	9.53	.....	03 43	
75,000	.....	.....	04 08	
79,800	9.54	.0007	04 40	Maximum resistance after rest.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
70,000	9.55	.....	05 02	Valves of testing machine remain at one setting.
69,000	9.56	.....	06 00	
68,700	9.57	.....	06 20	
67,700	9.58	.....	08 00	
67,600	9.59	.....	09 00	
67,300	9.60	.....	10 00	
67,150	9.60+	.....	12 00	
67,080	9.61	.....	14 00	
66,950	9.63	.....	20 00	
66,950	9.66	.....	25 00	
67,100	9.67	.....	30 00	
67,380	9.69	.....	35 00	
67,540	9.70	.0004	40 00	
70,300	9.70	.....	8 41 00	Valves changed. Speed increased slightly.
69,500	9.72	.0004	8 45 00	
71,200	.....	.....	8 45 30	Valves again changed, slightly increasing speed of shell.
71,000	9.74	.....	46 00	
70,600	9.80	.....	50 00	
70,200	9.97	.....	9 03 00	
70,600	10.10	.....	17 00	
71,600	10.29	.....	40 00	
72,080	10.44	.0008	10 04 00	
75,300	.....	.....	10 05 00	Valves again changed.
75,600	10.47	.....	05 08	
73,700	10.51	.....	07 00	
73,200	10.53	.....	08 00	
73,080	10.55	.....	09 00	
72,800	10.58	.....	10 00	
72,640	10.60	.....	11 00	
72,500	10.61	.....	12 00	
72,300	10.64	.....	13 00	
72,100	10.66	.....	14 00	
71,940	10.68	.....	15 00	
71,900	10.70	.....	16 00	
71,800	10.71	.....	17 00	
71,720	10.73	.....	18 00	
71,580	10.76	.....	19 00	
71,490	10.78	.....	20 00	
71,380	10.79	.....	21 00	
71,260	10.81	.....	22 00	
71,200	10.82	.....	23 00	
71,070	10.84	.....	10 24 00	
71,000	10.87	.....	25 00	
70,870	10.89	.....	26 00	
70,800	10.90	.....	27 00	
70,860	10.91	.....	28 00	
70,900	10.93	.....	29 00	
70,900	10.96	.....	30 00	
70,880	10.98	.0017	31 00	Valves again changed.
75,600	11.00	.....	10 31 30	
75,150	11.03	.....	32 00	
74,860	11.12	.....	33 00	
74,600	11.20	.....	34 00	
74,320	11.28	.....	35 00	
74,020	11.35	.....	36 00	
73,880	11.42	.....	37 00	
73,720	11.50	.....	38 00	
73,420	11.58	.....	39 00	
73,310	11.63	.....	40 00	
73,200	11.71	.....	41 00	
72,500	11.79	.....	42 00	
72,200	11.85	.....	43 00	
71,920	11.91	.....	44 00	
71,720	11.98	.....	45 00	
71,300	12.04	.....	46 00	
71,210	12.11	.....	47 00	
71,100	12.17	.006	48 00	Valves again changed.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
78,400	.....	.....	10 48 20	
79,200	12.33	.....	48 50	
79,940	12.65	.....	50 00	
80,980	12.93	.....	51 00	
81,120	13.19	.....	52 00	
81,100	.....	.....	52 30	
80,980	13.42	.0218	53 00	
81,350	13.66	.....	54 00	
81,900	13.88	.....	55 00	
83,120	14.09	.....	56 00	
84,100	14.28	.....	57 00	
84,280	14.49	.....	58 00	
83,950	.....	.....	58 30	
83,800	14.68	.....	59 00	
84,100	14.85	.....	11 00 00	
84,900	15.03	.....	11 01 00	
85,060	15.21	.0166	02 00	
				Valves again changed.
97,400	15.48	.....	11 02 30	
96,200	15.94	.....	03 00	
93,600	16.42	.....	03 30	
94,600	16.89	.....	04 00	
97,900	17.35	.....	04 30	
99,800	17.79	.....	05 00	
101,600	18.24	.....	05 30	
103,200	18.65	.....	06 00	
103,700	18.87	.0753	06 15	
				Valves closed and new stroke of accumulator piston taken.
74,300	18.91	.....	11 47 00	Load at end of rest.
88,900	18.92	.....	48 00	
85,000	18.93	.....	49 00	
84,050	18.95	.....	50 00	
83,400	18.96	.....	51 00	
85,400	18.98	.....	52 00	Valves gradually opened.
86,800	19.00	.....	53 00	
88,080	19.06	.....	54 00	
89,800	19.15	.....	55 00	
91,200	19.27	.....	56 00	
91,440	19.38	.....	57 00	
91,650	19.51	.....	58 00	
91,920	19.64	.....	59 00	
92,400	19.75	.0054	12 00 00	Valves closed.
80,000	.....	.....	12 00 30	
78,900	.....	.....	12 01 00	
5,000	.....	.....	.....	Released to initial load. Rested one-half hour.
5,000	19.72	.....	12 35 00	
68,000	19.76	.....	36 00	
68,200	.....	.....	36 20	
86,400	19.80	.....	12 37 00	
86,220	19.86	.....	38 00	
86,220	19.90	.....	39 00	
87,000	19.96	.004	40 00	Rate of speed increased.
88,300	20.03	.....	41 00	
89,020	20.10	.....	42 00	
91,300	20.21	.....	43 00	
92,100	20.32	.....	44 00	
92,600	20.44	.....	45 00	
93,000	20.55	.....	46 00	
93,400	20.62	.008	47 00	
				Speed of shell increased.
114,000	.....	.....	.....	Momentary maximum resistance. After which the resistance fell to about 94,500 pounds and there remained during the continuance of this speed.
94,500	23.11	.0174	12 59 30	
75,600	23.19	.....	1 01 20	Under reduced speed.
75,300	23.21	.003	1 02 00	
74,700	23.26	.....	1 03 00	Rate of speed increased.
75,850	23.32	.005	04 00	Do.
77,100	23.41	.007	05 00	
				Second follower put in machine.

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	23.41	.....	2 07 00	
70,000	23.47	.....	2 08 10	
74,200	23.49	.003	2 09 00	
78,400	23.60	.009	2 10 00	
77,300	23.79	.016	2 11 00	
78,800	24.02	.019	2 12 00	
80,150	24.26	.020	2 13 00	Rate of speed gradually increased.
83,350	24.55	.024	2 14 00	
85,700	24.91	.030	2 15 00	
83,100	25.64	.061	2 16 00	
76,200	26.57	.....	17 00	
75,200	27.39	.069	2 18 00	
75,050	28.27	.....	19 00	
75,200	29.11	.....	20 00	
74,600	30.15	.077	2 21 00	
74,700	30.89	.....	22 00	
76,850	31.74	.066	2 23 00	
75,200	32.63	.....	24 00	
73,500	33.51	.074	2 25 00	
71,500	34.35	.....	26 00	
71,400	35.21	.071	2 27 00	
71,700	36.03	.....	28 00	
71,100	36.79	.....	29 00	
69,200	37.51	.064	2 30 00	
66,500	38.12	.....	2 31 00	
65,100	38.58	.....	32 00	
65,500	39.06	.....	33 00	
66,200	39.69	.045	2 34 00	
67,300	40.33	.....	35 00	
67,200	41.05	.....	36 00	
67,200	41.77	.058	2 37 00	
66,750	42.39	.....	38 00	
67,600	43.02	.....	39 00	
67,750	43.71	.054	2 40 00	
67,300	44.31	.....	41 00	
66,800	44.87	.....	42 00	
65,100	45.43	.048	2 43 00	
64,500	46.00	.....	44 00	
65,300	46.51	.045	2 45 00	
				New stroke of ram taken.
5,000	46.51	.....	2 57 00	
65,100	46.88	.....	58 00	
64,500	47.81	.....	59 00	
63,300	48.96	.068	3 00 00	
65,500	49.98	.....	3 01 00	
64,300	50.96	.083	3 02 00	
63,100	51.89	.....	03 00	
61,500	.....	.....	04 00	
60,500	53.55	.072	3 05 00	
59,400	54.40	.....	06 00	
57,050	56.09	.068	3 08 00	
59,900	57.51	.....	10 00	
62,600	59.01	.063	3 12 99	
60,400	60.56	.065	3 14 00	
58,500	61.91	.056	16 00	
61,100	64.01	.087	18 00	
62,800	66.16	.090	20 00	
				Rate increased.
64,000	.....	.....	.....	Load momentarily reached, then gradually fell to 60,200 pounds.
60,200	68.29	.177	3 21 00	
.....	68.37	.....	22 00	Slower rate of speed.
51,400	68.40	.....	23 00	
52,000	68.41	.....	24 00	
53,200	68.42	.0025	25 00	
52,700	68.42	.....	26 00	
53,400	68.43	.....	27 00	Valves gradually opened a slight amount.
53,600	68.44	.....	28 00	
54,100	68.46	.....	29 00	
54,380	68.47	.....	30 00	
54,680	68.47+	.....	31 00	
55,400	68.47+	.....	32 00	
55,900	68.47+	.....	33 00	Rate increased.
55,800	68.49	.....	34 00	
54,850	68.53	.....	35 00	
54,800	68.57	.....	36 00	
55,000	68.61	.....	3 37 00	
55,060	68.65	.....	38 00	

No. 8358—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
57,800	69.20	.005	39 00	Rate increased.
61,100	70.21	.084	40 00	
.....	70.40	.....	.....	Stroke of piston exhausted. New stroke of piston taken.
5,000	70.40	.....	3 48 00	
62,300	71.27	.....	49 00	
67,600	72.02	.067	50 00	
71,200	72.71	.058	51 00	
77,300	73.40	.058	52 00	
77,300	74.02	.052	53 00	
79,200	74.56	.045	54 00	
80,300	75.06	.....	55 00	
82,000	85.50	.039	56 00	
70,300	77.03	.127	57 00	Rate increased, accompanied by immediate drop in resistance. Shell thought to have been in an oblique position in the bore.
50,500	78.80	.147	3 58 00	
0	79.69	.074	59 00	

The metal of the band flowed under the lands of the gun, the copper being forced to the rear about ″.20 by each land.

Six sections between lands were fractured just forward of the rear end of the band.

The band generally showed contact with the grooves of the gun, but there were places which did not appear to have reached a bearing at the grooves.

No. 8361.

[Third experiment.]

Shell again rebanded and forced through the gun.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.	Remarks.
Pounds.	*Inches.*	*Foot.*	*h. m. s.*	
5,000	0.	0.	2 10 40	Initial load.
129,000	.80	.200	11 00	Maximum resistance observed
86,000	1.90	.....	.....	
94,000	3.20	.....	.....	
98,000	4.09	.548	2 11 30	
71,600	4.11	.....	2 18 30	Stood at, while ram was pumped up.
108,000	8.15	.577	19 05	Resistance while shell was traveling.
72,600	8.18	.....	2 26 00	Stood at, while ram was pumped up.
112,500	12.30	.736	26 28	Resistance while shell was traveling.
78,000	12.31	.....	2 34 00	Stood at, while ram was pumped up.
				Gradually increased rate of travel of shell.
101,000	.....	.....	.....	Shell began to move freely.
129,000	.....	.....	.....	Resistance gradually increased to 129,000 pounds while under the maximum speed (about 9″ per minute), then gradually decreased to 123,000 pounds as the speed was gradually lowered.
123,000	16.38	.339	2 35 00	
92,000	16.43	.....	2 42 00	Stood at, while ram was pumped up.
				Same treatment as last recorded, viz, gradually increased rate of travel of shell.
114,000	.....	.....	.....	When the pressure reached 114,000 pounds the shell was traveling freely.
138,000	.....	.....	.....	The speed was gradually increased until the resistance reached 138,000 pounds, at which time the travel was about the maximum the testing machine will give, or about 9″ per minute. The speed was then reduced rather more abruptly than in the preceding observation, the resistance in the meantime falling to 136,000 pounds. This stage of the test occupied 50 seconds.
136,000	20.50	.407	2 42 50	
99,000	.....	.....	.....	
66,500	20.49	.....	3 18 00	Resistance immediately after travel of shell ceased, which was gradually lowered to 66,500 pounds at the time specified.
64,600	20.49	.....	3 20 00	Test resumed at slow speed.
71,600	20.49	.....	3 21 00	
74,800	20.49	.....	22 00	
80,300	20.50	.....	23 00	
85,200	20.50	.....	24 00	
95,000	20.50	.....	25 00	
99,900	20.50	.....	26 00	
101,300	20.50	.....	27 00	
107,500	20.50	.....	28 00	Valve setting unchanged.
112,400	20.50	.....	29 00	
115,400	20.50	.....	30 00	
117,400	20.50	.....	31 00	
116,600	20.50	.....	32 00	
115,000	20.51	.....	33 00	
113,800	20.51	.....	34 00	
112,700	20.51	.....	38 00	
112,300	20.51	.....	47 00	
115,700	.....	.....	3 48 00	Valves changed—opened slightly.
115,800	.....	.....	3 49 00	
115,200	20.51	.....	51 30	Valves opened slightly.
119,000	20.52	.....	53 00	
114,900	.....	.....	55 00	As shown by a micrometer, the speed of travel is now ″.0022 per minute.
114,000	20.53	.....	3 59 00	
105,000	.....	.....	.....	Load left on the shell.
				Test discontinued.
4,200	.....	.....	.....	Load found on shell after resting about 64 hours. Reduction of load attributed to leakage of oil from straining cylinder through valves.

No. 8361.

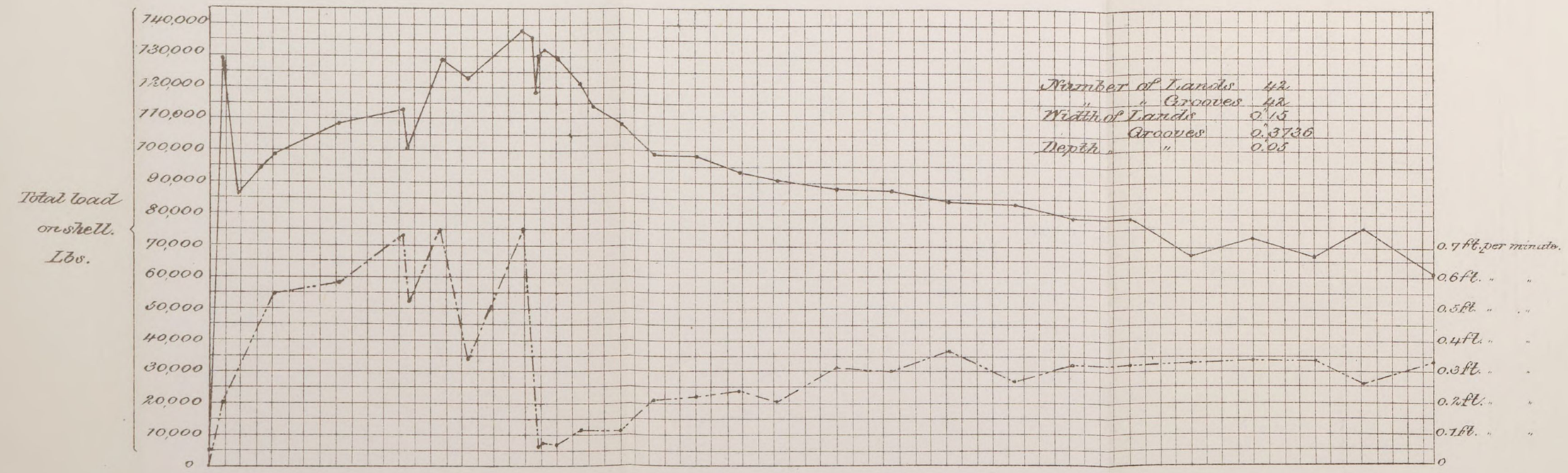
7-inch B.L. Steel Siege Howitzer.

Model 1890.

Diagram showing curves of resistance, and velocity, of banded shell when forced through the bore.

3rd. experiment.

Bore not lubricated.



Rifling, 1 turn in 50 Cals. at origin, increasing to 1 turn in 25 Cals. at 1½ Cals. from muzzle, and uniform to muzzle.

Micrometer attached to gun and compression platform of testing machine.

No. 8361—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
Pounds.	*Inches.*	*Foot.*	*h.*	*m.*	*s.*	
4, 200	0.	.....	.....			
10, 000	.0014	.....	8	39	00	
10, 000	.0015	.....		44	00	
15, 000	.0028	.....		45	15	
15, 000	.0028	.....		50	15	
20, 000	.0040	.....		50	30	
20, 000	.0040	.....		55	30	
25, 000	.0054	.....		56	00	
25, 000	.0054	.....	9	03	00	
30, 000	.0065	.....		03	40	
30, 000	.0066	.....		08	40	
30, 000	.0066	.....		13	40	
35, 000	.0078	.....		13	45	
35, 000	.0079	.....		18	45	
40, 000	.0090	.....		19	00	
40, 000	.0091	.....		24	00	
45, 000	.0101	.....		24	30	
45, 000	.0102	.....		29	30	
50, 000	.0113	.....		30	00	
50, 000	.0113	.....		35	00	
55, 000	.0124	.....		35	40	
55, 000	.0124	.....		40	40	
60, 000	.0136	.....		47	50	
60, 000	.0136	.....		52	50	
65, 000	.0146	.....	9	53	20	
65, 000	.0147	.....		58	20	
70, 000	.0157	.....		58	45	
70, 000	.0158	.....	10	03	45	
75, 000	.0168	.....		04	00	
75, 000	.0169	.....		09	00	
80, 000	.0180	.....		09	30	
80, 000	.0180	.....		14	30	
85, 000	.0190	.....		14	40	
85, 000	.0190	.....		19	40	
90, 000	.0200	.....		20	00	
90, 000	.0200	.....	10	25	00	
80, 000	.0180	.....	.....			
60, 000	.0140	.....	.....			
40, 000	.0096	.....	.....			
20, 000	.0049	.....	.....			
4, 200	.0012	.....	.....			
80, 000	.0180	.....	.....			
90, 000	.0200	.....	.....			
95, 000	.0209	.....	10	28	40	
95, 000	.0210	.....		33	40	
100, 000	.0218	.....		34	00	
100, 000	.0220	.....		55	30	
105, 000	.0229	.....		56	10	
105, 000	.0229	.....	11	01	10	
110, 000	.0239	.....	11	01	25	
110, 000	.0240	.....		06	25	
115, 000	.0249	.....		06	40	
115, 000	.0250	.....		11	40	
120, 000	.0260	.....		12	05	
120, 000	.0262	.....		17	05	
125, 000	.0273	.....		17	50	
125, 000	.0300	.....		22	50	
125, 000	.0450	.....	11	23	50	Load reduced.
115, 000	.0496	.....	11	24	40	
115, 000	.0539	.....		25	40	Load again reduced.
110, 000	.0539	.....	11	26	20	
110, 000	.0542	.....		31	20	
110, 000	.0544	.....		34	20	
110, 000	.0545	.....		39	00	
110, 000	.0545	.....		42	00	
115, 000	.0554	.....		42	45	
115, 000	.0554	.....		43	25	
115 000	.0557	.....		44	45	
115, 000	.0560	.....		45	45	
115, 000	.0563	.....		46	45	

No. 8361—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Time of observations.			Remarks.
Pounds.	*Inches.*	*Foot.*	*h.*	*m.*	*s.*	
115,000	.0566	.....		47	45	
115,000	.0570	.....		48	45	
115,000	.0574	.....		49	45	
115,000	.0577	.....		50	45	
115,000	.0580	.....	11	51	45	
115,000	.0584	.....		52	45	
118,000	.....	.....	.....			Test discontinued. Micrometer removed
118,000	20.56	.....	1	29	00	Test resumed after 1½ hours rest.
130,200	20.88	0.053	1	29	30	
132,000	21.25	.062		30	00	
132,200	21.70	.075		30	30	
129,100	22.09	.065		31	00	
121,000	23.42	.111	1	32	00	
.....	23.75	.....	.....			Total travel.
						Second follower put in machine.
5,000	23.75	.....	3	31	15	
114,000	24.29	.....		32	00	
108,000	26.00	.107		33	00	
98,400	28.42	.202		34	00	
98,100	31.03	.217		35	00	
93,000	33.80	.231		36	00	
91,100	36.15	.196		37	00	
88,100	39.88	.311		38	00	
87,600	43.47	.....	3	39	00	
84,200	47.13	.366	3	39	50	
						New stroke of piston taken.
5,000	47.13	.....	3	48	40	
83,000	51.33	.262		50	00	
78,300	55.13	.317		51	00	
78,500	58.93	.317		52	00	
67,700	62.83	.325		53	00	
73,700	66.83	.333		54	00	
67,300	70.81	.332		55	00	
						New stroke of piston taken.
5,000	70.81	.....	4	14	00	
75,800	73.91	.258		15	00	
61,000	77.81	.325	4	16	00	
						Test completed.

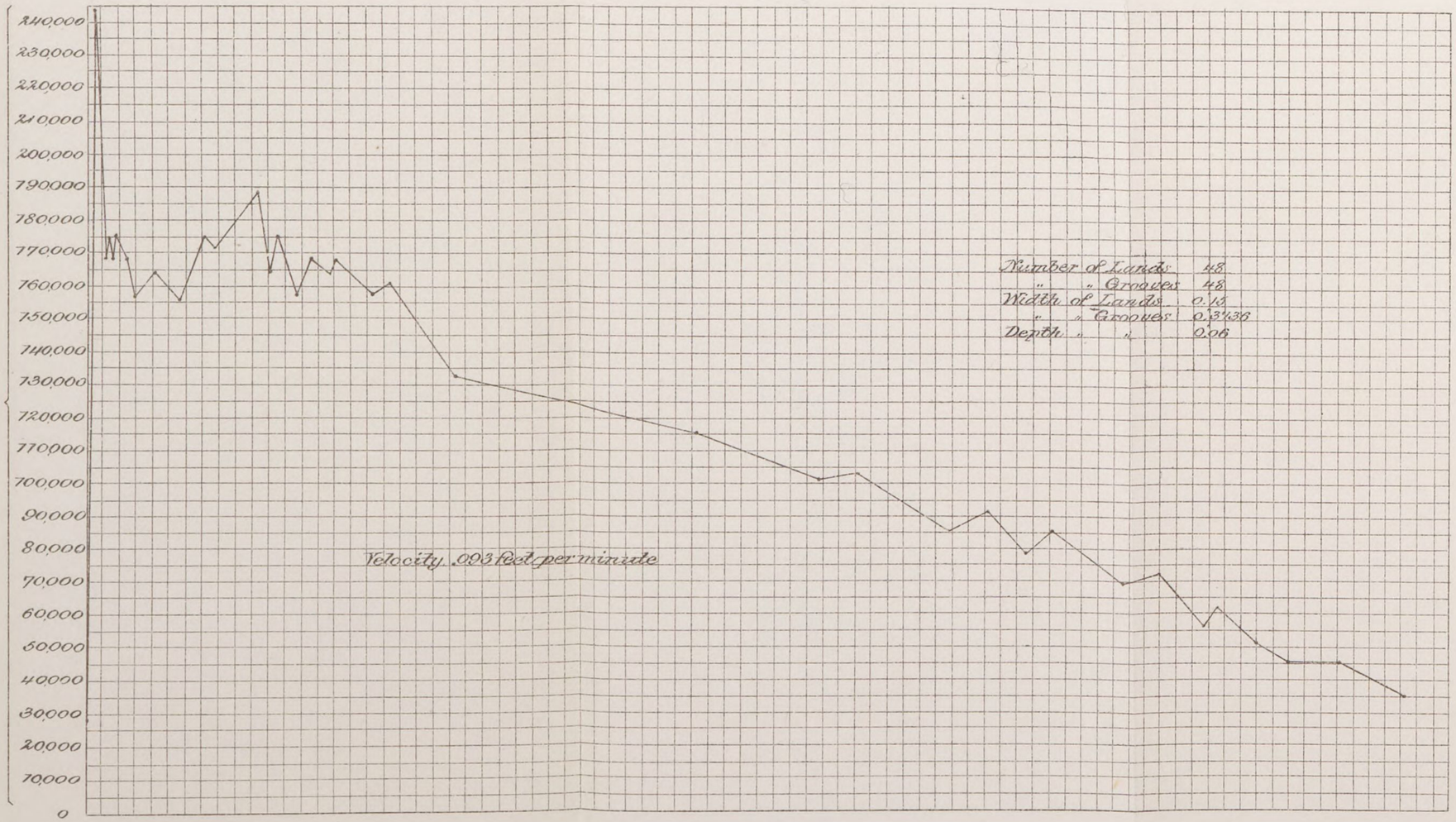
No. 8371.

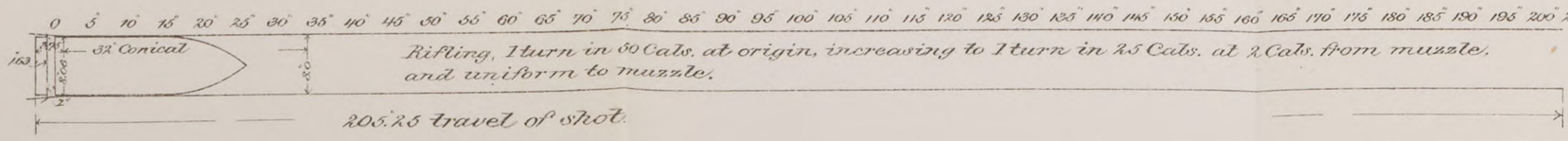
8-inch B.L. Rifle. Steel. 14½ tons.

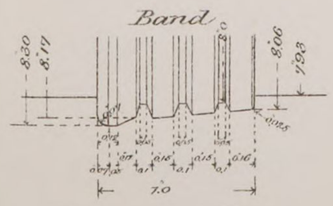
Model 1888.

Diagram showing curve of resistance

of banded shot when forced through the bore







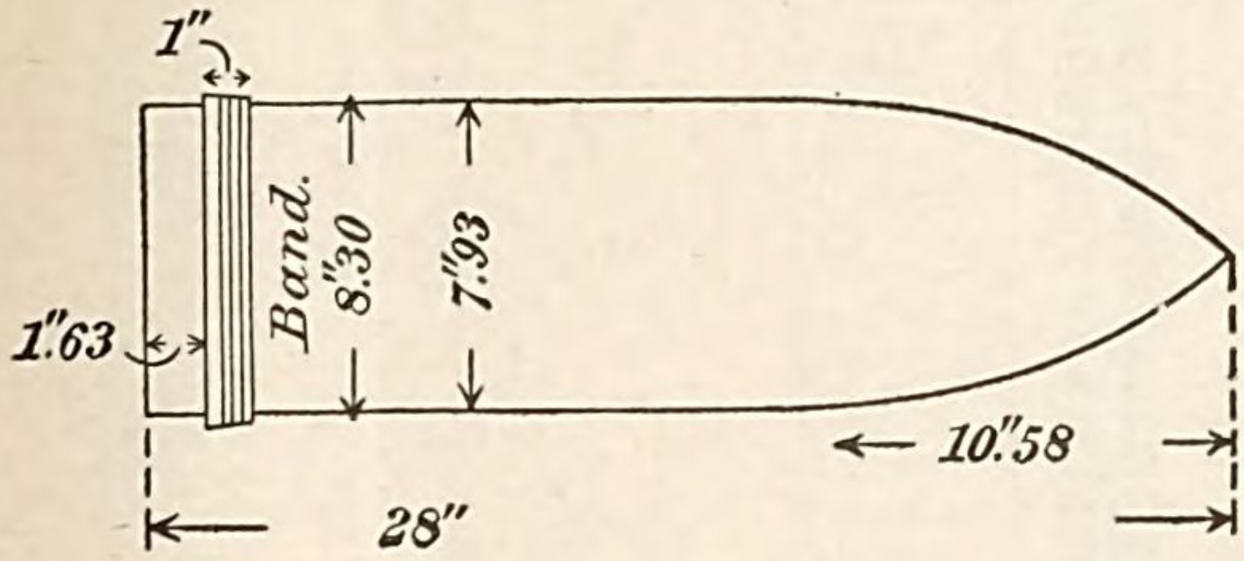
8-INCH B. L. RIFLE—STEEL—14½ TONS.

No. 8371.

Marks on rifle:

"Bethlehem Steel Model 1888" } on trunnion.

"8-in. No. 7—Wt. 31,915 lbs. (14¼ tons), W. B. G. Insp. W. P. F. 1893" } on muzzle.



Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
Pounds.	*Inch.*	*Foot.*	
28, 350	0.	0.	Initial load.
42, 530	.25	----------	
47, 840	.50	----------	
63, 790	.75	----------	
92, 140	1.00	----------	
131, 130	1.25	----------	
243, 120	1.50	.093	
232, 130	1.75	----------	
208, 390	2.00	----------	
188, 540	2.25	----------	
168, 340	2.50	----------	
168, 340	2.75	.093	
175, 430	3.00	----------	
175, 430	3.25	.093	
171, 880	3.50	----------	
168, 340	3.75	.093	
171, 880	4.00	----------	
175, 430	4.25	----------	
175, 430	4.50	.093	
168, 340	4.75	----------	
164, 800	5.00	----------	
168, 340	5.25	----------	
168, 340	5.50	----------	
168, 340	5.75	----------	
168, 340	6.00	.093	
159. 480	6.25	----------	
159, 480	6.50	----------	
159, 480	6.75	----------	
159, 480	7.00	----------	
157, 350	7.25	----------	
157, 350	7.50	.093	
159, 480	7.75	----------	
159, 480	8.00	----------	
159, 480	8.25	----------	
161, 610	8.50	----------	
161, 610	8.75	----------	
161, 610	9.00	----------	
164, 800	9.25	----------	
164, 800	9.50	----------	
164, 800	9.75	----------	
164, 800	10.00	----------	
164, 800	10.25	.093	
161, 610	10.50	----------	
161, 610	10.75	----------	
161, 250	11.00	----------	
159, 480	11.25	----------	
159, 480	11.50	----------	
159, 480	11.75	----------	
159, 480	12.00	----------	

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
159, 480	12. 25	.....	
159, 480	12. 50	.....	
159, 480	12. 75	.....	
159, 480	13. 00	.....	
158, 060	13. 25	.....	
157, 350	13. 50	.....	
157, 350	13. 75	.....	
155, 940	14. 00	.093	
157. 350	14. 25	.....	
157, 350	14. 50	.....	
157, 350	14. 75	.....	
157, 350	15. 00	.....	
157, 350	15. 25	.....	
159, 480	15. 50	.....	
161, 610	15. 75	.....	
164, 800	16. 00	.....	
166, 570	16. 25	.....	
170, 110	16. 50	.....	
171, 880	16. 75	.....	
171, 880	17. 00	.....	
171, 880	17. 25	.....	
175, 430	17. 50	.....	
175, 430	17. 75	.093	
173, 660	18. 00	.....	
171, 880	18. 25	.....	
171, 880	18. 50	.....	
171, 880	18. 75	.....	
171, 880	19. 00	.....	
171, 880	19. 25	.....	
171, 880	19. 50	.093	
173, 660	19. 75	.....	
173, 660	20. 00	.....	
173, 660	20. 25	.....	
173, 660	20. 50	.....	
175, 430	20. 75	.....	
175, 430	21. 00	.....	
178, 970	21. 25	.....	
178, 970	21. 50	.....	
178, 970	21. 75	.....	
178, 970	22. 00	.....	
181, 450	22. 25	.....	
182, 870	22. 50	.....	
182. 870	22. 75	.....	
182, 870	23. 00	.....	
182, 870	23. 25	.....	
182, 870	23. 50	.....	
186, 060	23. 75	.....	
186, 060	24. 00	.....	
188, 540	24. 25	.....	
188, 540	24. 50	.....	
188, 540	24. 75	.....	
188, 540	25. 00	.....	
186. 060	25. 25	.....	
188, 540	25. 50	.....	
188. 540	25. 75	.....	
188, 540	26. 00	.093	
186, 060	26. 25	.....	
182, 870	26. 50	.....	
178. 970	26. 75	.....	
173, 660	27. 00	.....	
168, 340	27. 25	.....	
164, 800	27. 50	.....	
164, 800	27. 75	.093	
168, 340	28. 00	.....	
171, 880	28. 25	.....	
173, 660	28. 50	.....	
175, 430	28. 75	.....	
175. 430	29. 00	.093	
173, 660	29. 25	.....	
171, 880	29. 50	.....	
171, 880	29. 75	.....	
168. 340	30. 00	.....	
159, 480	30. 25	.....	
161, 610	30. 50	.....	
159, 480	30. 75	.....	
159. 480	31. 00	.....	
157, 350	31. 25	.....	

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
157, 350	31. 50	----------	
157, 350	31. 75	.093	
159, 480	32. 00	----------	
161, 250	32. 25	----------	
161, 610	32. 50	----------	
163, 020	32. 75	----------	
164, 800	33. 00	----------	
168, 340	33. 25	----------	
168, 340	33. 50	----------	
168, 340	33. 75	.093	
166, 570	34. 00	----------	
168, 340	34. 25	----------	
168, 340	34. 50	----------	
168, 340	34. 75	----------	
168, 340	35. 00	----------	
166, 570	35. 25	----------	
168, 340	35. 50	----------	
166, 570	35. 75	----------	
164, 800	36. 00	----------	
164, 800	36. 25	----------	
164, 800	36. 50	----------	
164, 800	36. 75	.093	
166, 570	37. 00	----------	
166, 570	37. 25	----------	
168, 340	37. 50	----------	
168, 340	37. 75	.093	
166, 570	38. 00	----------	
164, 800	38. 25	----------	
164, 800	38. 50	----------	
164, 800	38. 75	----------	
161, 610	39. 00	----------	
161, 610	39. 25	----------	
161, 610	39. 50	----------	
161, 250	39. 75	----------	
161, 250	40. 00	----------	
159, 480	40. 50	----------	
159, 480	41. 00	----------	
159, 480	41. 50	----------	
159, 480	42. 00	----------	
158, 060	42. 50	----------	
158, 060	43. 00	----------	
158, 060	43. 50	.093	
159, 480	44. 00	----------	
161, 250	44. 50	----------	
161, 610	45. 00	----------	
161, 610	45. 50	.093	
161, 250	46. 00	----------	
159, 480	46. 50	----------	
159, 480	47. 00	----------	
157, 350	47. 50	----------	
155, 940	48. 00	----------	
155, 940	48. 50	----------	
157, 350	49. 00	----------	
155, 940	49. 50	----------	
154, 160	50. 00	----------	
151, 680	50. 50	----------	
148, 850	51. 00	----------	
145, 300	51. 50	----------	
145, 300	52. 00	----------	
145, 300	52. 50	----------	
145, 300	53. 00	----------	
143, 530	53. 50	----------	
141, 760	54. 00	----------	
141, 760	54. 50	----------	
141, 760	55. 00	----------	
139, 630	55. 50	----------	
132, 550	56. 00	.093	
115, 530	93. 00	.093	
111, 280	94. 00	----------	
109, 150	95. 00	----------	
108, 450	96. 00	----------	
109, 150	97. 00	----------	
108, 450	98. 00	----------	
108, 090	99. 00	----------	
106, 320	100. 00	----------	
108, 450	106. 00	----------	

No. 8371—Continued.

Resistance.	Distance shot traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
101, 360	112. 00	.....	Speed reduced slightly.
104, 550	118. 00	.....	Changed rods.
95, 690	118. 00	.....	Started.
95, 690	119. 00	.....	
92, 140	120. 00	.....	
90, 730	121. 00	.....	
88, 600	122. 00	.....	
90, 020	123. 00	.....	
90, 020	124. 00	.....	
90, 020	125. 00	.....	
90, 730	126. 00	.....	
91, 440	127. 00	.....	
91, 440	128. 00	.....	
91, 440	129. 00	.....	
90, 020	130. 00	.....	
87, 180	131. 00	.....	
85, 760	132. 00	.093	
86, 120	133. 00	.....	
88, 600	134. 00	.....	
90, 730	135. 00	.....	
91, 790	136. 00	.....	
92, 140	137. 00	.....	
92, 140	138. 00	.....	
90, 370	139. 00	.....	
87, 180	140. 00	.....	
85, 760	141. 00	.....	
81, 510	142. 00	.....	
79, 380	143. 00	.....	
78, 680	144. 00	.093	
80, 090	145. 00	.....	
85, 060	146. 00	.....	
85, 060	147. 00	.....	
85, 760	148. 00	.093	Rested.
81, 510	148. 00	.....	
83, 640	149. 00	.....	
83, 640	150. 00	.....	
81, 510	151. 00	.....	
79, 380	152. 00	.....	
77, 960	153. 00	.....	
75, 130	154. 00	.....	
70, 880	155. 00	.....	
70, 880	156. 00	.....	
69, 460	157. 00	.....	
69, 460	158. 00	.....	
69, 460	159. 00	.093	
70, 880	160. 00	.....	
70, 880	161. 00	.....	
70, 880	162. 00	.....	
71, 590	163. 00	.....	
71, 590	164. 00	.....	
72, 300	165. 00	.093	
71, 590	166. 00	.....	
71, 590	167. 00	.....	
70, 880	168. 00	.....	
64, 510	169. 00	.....	
60, 250	170. 00	.....	
56, 700	171. 00	.....	
56, 700	172. 00	.093	
58, 480	173. 00	.....	
62, 370	174. 00	.093	
60, 960	175. 00	.....	
60, 250	176. 00	.....	
60, 250	177. 00	.....	
60, 250	178. 00	.....	Rested.
58, 480	178. 00	.....	
55, 290	179. 00	.....	
51, 740	180. 00	.093	
48, 200	181. 00	.....	
47, 840	182. 00	.....	
47, 490	183. 00	.....	
47, 140	184. 00	.....	
45, 360	185. 00	.093	
45, 360	186. 00	.....	

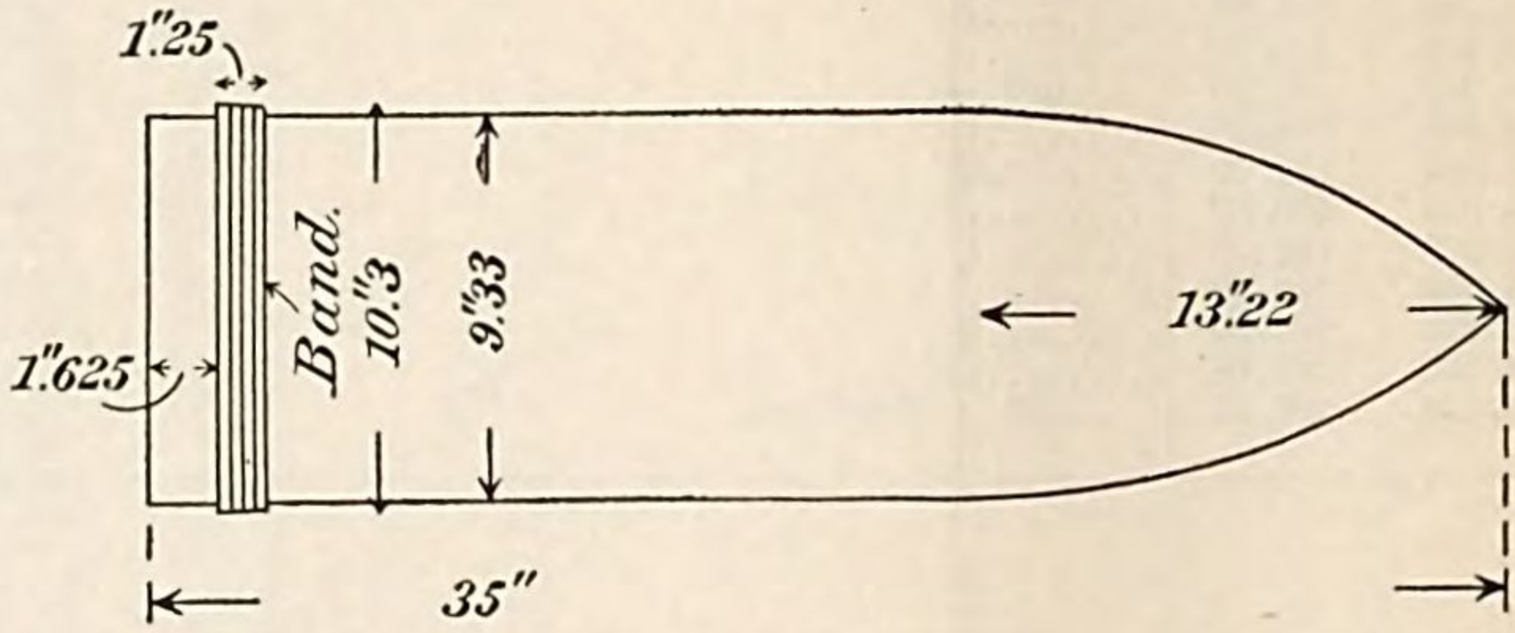
No. 8371—Continued.

Resistance.	Distance. shot traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
45, 360	187. 00	.....	
45, 360	188. 00	.....	
45, 360	189. 00	.....	
45, 360	190. 00	.....	
45, 360	191. 00	.....	
45, 360	192. 00	.....	
45, 360	193. 00	.....	
44, 650	194. 00	.....	
43, 940	195. 00	.093	
44, 300	196. 00	.....	
44, 300	197. 00	.....	
44, 300	198. 00	.....	
44, 300	199. 00	.....	
42, 530	200. 00	.....	
41, 820	201. 00	.....	
34, 730	202. 00	.....	
35, 440	203. 00	.093	Band out.

10-INCH B. L. RIFLE—STEEL. 30 TONS.

No. 8504.

Marks on rifle:
"Bethlehem Steel Model 1888." } on trunnion.
30 tons
"10-in. No. 21, Wt. 67,060 lbs. F. E. H. Insp. Watervliet Arsenal, 1894." } on muzzle.



Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
54,680	0.	0.	Initial load.
87,490	.50	----------	
210,520	1.00	----------	
312,770	1.50	.053	
265,200	2.00	----------	
191,380	2.50	----------	
178,260	3.00	----------	
172,790	3.50	----------	
171,690	4.00	----------	
168,410	4.50	----------	
168,410	5.00	----------	
168,410	5.50	.053	
171,690	6.00	----------	
171,690	6.50	----------	
172,790	7.00	----------	
172,790	7.50	----------	
172,790	8.00	----------	
174,980	8.50	----------	
174,980	9.00	----------	
174,980	9.50	----------	
178,260	10.00	.053	
178,260	10.50	----------	
178,260	11.00	----------	
178,260	11.50	.053	
174,980	12.00	----------	
172,790	12.50	.053	
178,260	13.00	----------	
178,260	13.50	----------	
181,540	14.00	.053	
174,980	14.50	----------	
172,790	15.00	----------	
172,790	15.50	----------	
174,980	16.00	----------	
172,790	16.50	----------	
172,790	17.00	.053	
178,260	17.50	----------	
181,540	18.00	----------	
185,910	18.50	----------	
185,910	19.00	----------	
181,540	19.50	----------	
181,540	20.00	.053	
185,910	20.50	----------	
188,640	21.00	----------	
191,380	21.50	.053	
191,380	22.00	----------	
191,380	22.50	.053	

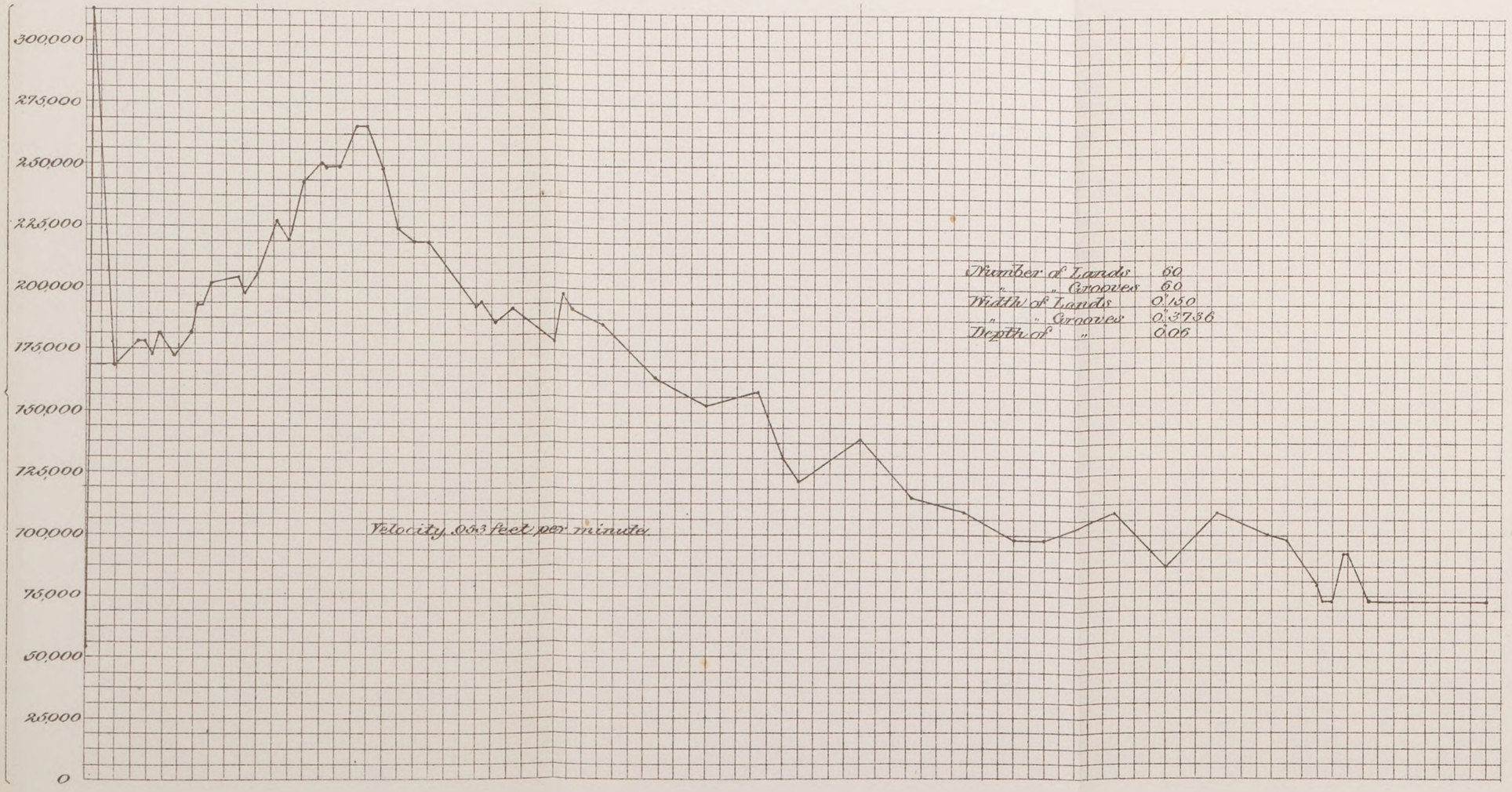
No. 8504.

10-inch B.L. Rifle Steel. 30 tons.

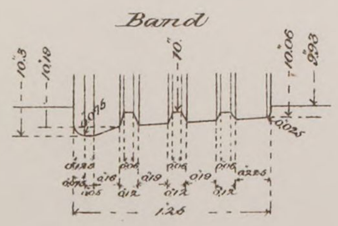
Model 1888 modified.

Diagram showing curve of resistance

of banded shell when forced through the bore.



Band



No. 8504—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
194, 112	23.00	.....	
196, 850	23.50	.....	
202, 320	24.00	.053	
204, 500	24.50	.....	
205, 600	25.00	.....	
202, 320	25.50	.....	
202, 320	26.00	.....	
202, 320	26.50	.....	
202, 320	27.00	.....	
202, 320	27.50	.....	
202, 320	28.00	.....	
204, 500	28.50	.....	
204, 500	29.00	.053	
202, 320	29.50	.....	
199, 580	30.00	.....	
196, 850	30.50	.053	
201, 222	31.00	.....	
202, 320	31.50	.....	
202, 320	32.00	.....	
204, 500	32.50	.....	
205, 600	33.00	.053	
215, 440	33.50	.....	
210, 520	34.00	.....	
217, 626	34.50	.....	
218, 720	35.00	.....	
219, 810	35.50	.....	
219, 810	36.00	.....	
224, 188	36.50	.....	
226, 920	37.00	.053	
224, 188	37.50	.....	
221, 454	38.00	.....	
218, 720	38.50	.....	
218, 720	39.00	.053	
219, 810	39.50	.....	
226, 920	40.00	.....	
232, 390	40.50	.....	
237, 860	41.00	.....	
242, 780	41.50	.053	
242, 780	42.00	.....	
			New stroke of piston.
237, 860	.....	.....	Test resumed.
240, 590	42.50	.....	
243, 870	43.00	.....	
249, 340	43.50	.....	
254, 260	44.00	.....	
251, 530	44.50	.....	
251, 530	45.00	.....	
251, 530	45.50	.053	
249, 340	46.00	.053	
249, 340	47.00	.....	
249, 340	48.00	.....	
251, 530	49.00	.053	
254, 260	50.00	.....	
265, 200	51.00	.....	
265, 200	52.00	.053	
265, 200	53.00	.....	
254, 260	54.00	.053	
254, 260	55.00	.....	
248, 790	56.00	.....	
243, 870	57.00	.053	
242, 780	58.00	.....	
224, 190	59.00	.....	
224. 190	60.00	.053	
221, 450	61.00	.....	
218, 720	62.00	.....	
218, 720	63.00	.053	
218, 720	64.00	.....	
218, 720	65.00	.....	
191, 380	66.00	.053	
194, 110	75.00	.053	
	76.00	.....	
			New stroke of piston.
191, 380	.....	.....	Test resumed.
191, 380	77.00	.....	
188, 650	78,00	.053	
185, 910	79.00	.....	

No. 8504—Continued.

Resistance.	Distance shell traveled.	Velocity per minute.	Remarks.
Pounds.	*Inches.*	*Foot.*	
178, 260	80. 00	.....	
178, 260	81. 00	.....	
191, 380	82. 00	.053	
188, 650	83. 00	.....	
185, 910	84. 00	.....	
185, 910	85. 00	.....	
185, 910	86. 00	.....	
181, 540	87. 00	.....	
179, 350	88. 00	.....	
178, 260	89. 00	.....	
178, 260	90. 00	.053	
			New stroke of piston.
172, 790	.....	.....	Test resumed.
172, 790	91. 00	.....	
176, 850	92. 00	.053	
191, 380	94. 00	.053	
185, 910	100. 00	.053	
164, 040	110. 00	.053	
153, 100	120. 00	.053	
158, 570	130. 00	.053	
131, 230	135. 00	.053	
122, 480	138. 00	.053	
123, 580	139. 00	.053	
131, 230	140. 00	.....	
139, 430	150. 00	.053	
115, 920	160. 00	.053	
109, 910	170. 00	.053	
98, 420	180. 00	.053	
98, 420	186. 00	.053	
			New stroke of piston.
115, 920	.....	.....	Test resumed.
109, 360	200. 00	.053	
87, 490	210. 00	.053	
109, 360	220. 00	.053	
101, 160	230. 00	.053	
98, 420	234. 00	.053	
			New stroke of piston.
115, 920	.....	.....	Test resumed.
98, 420	235. 00	.....	
95, 690	236. 00	.....	
90, 220	237. 00	.....	
90, 220	238. 00	.....	
87, 490	239. 00	.....	
79, 830	240. 00	.035	
73, 820	241. 00	.035	
73, 820	242. 00	.....	
73, 820	243. 00	.035	
84, 750	244. 00	.....	
92, 960	245. 00	.035	
92, 960	246. 00	.035	
79, 830	247. 00	.....	
73, 820	248. 00	.....	
73, 820	249. 00	.....	
73, 270	250. 00	.....	
73, 270	270. 00	.035	

HELICAL SPRINGS FOR GUN CARRIAGES.

HELICAL SPRINGS FOR GUN CARRIAGES.

Springs consist of nest of three concentric springs each.

DESCRIPTION OF SPRINGS.

	No. 1.	No. 2.
Weight	24 lbs. 6 oz.	24 lbs. 9 oz.
Outside coil:		
Diameter of wire	1″.12	1″.12
Outside diameter of coil	5.95	6.05
Inside diameter of coil	3.75	3.76
Middle coil:		
Diameter of wire	.75	.75
Outside diameter of coil	3.68	3.68
Inside coil:		
Diameter of wire	.38	.38
Outside diameter of coil	2.01	2.00

COMPRESSION OF SPRINGS.

Applied loads.	No. 8322, spring No. 1.		No. 8323, spring No. 2.	
	Height.	Compression.	Height.	Compression.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
0	6.17	0.	6.21	0.
500	6.11	.06	6.14	.07
1,000	6.06	.11	6.09	.12
2,000	5.99	.18	6.00	.21
3,000	5.89	.28	5.91	.30
5,000	5.75	.42	5.76	.45
10,000	5.37	.80	5.36	.85
15,000	4.94	1.23	4.97	1.24
10,000	5.29	.88	5.33	.88
5,000	5.67	.50	5.70	.51
1,000	6.04	.13	6.07	.14

Compression of helical springs for 12-inch spring return mortar carriages.

Springs made by the Crescent Steel Company, Pittsburg, Pa.

Four springs placed in the testing machine and closed down with 225,000 pounds.

They were held closed for a period of sixty-four hours. When the load was released to 18,000 pounds the height of the springs was 13″.19.

TESTS OF INDIVIDUAL SPRINGS, WHICH CONSIST OF DOUBLE COILS.

No. 8324.

	Outside coil.	Inside coil.
	Inches.	*Inches.*
Diameter of wire	1.74	1.26
Height	13.77	13.70
Distance between coils	1.00	.55
Exterior diameter, about	8.99	5.47
Interior diameter, about	5.56	3.02
Weight ..... pounds..	80½	34½

No. 8324—Continued.

Applied loads.	Total height.	Compression.	Remarks.
Pounds.	*Inches.*	*Inches.*	
----------	13.92	---------	Outside coil in contact with platforms of machine.
1,500	13.60	0.32	Inside coil in contact with machine.
2,000	13.54	.38	
2,500	13.48	.44	
3,000	13.43	.49	
3,500	13.37	.55	
4,000	13.32	.60	
4,500	13.27	.65	
5,000	13.23	.69	
6,000	13.14	.78	
7,000	13.04	.88	
8,000	12.95	.97	
9,000	12.87	1.05	
10,000	12.79	1.13	
12,000	12.63	1.29	
14,000	12.49	1.43	
16,000	12.33	1.59	
18,000	12.18	1.74	
20,000	12.04	1.88	
22,000	11.89	2.03	
24,000	11.74	2.18	
26,000	11.59	2.33	
28,000	11.43	2.49	
30,000	11.28	2.64	
32,000	11.11	2.81	
34,000	10.96	2.96	
36,000	10.79	3.13	
38,000	10.61	3.31	
40,000	10.44	3.48	
42,000	10.26	3.66	
44,000	10.09	3.83	
46,000	9.92	4.00	
48,000	9.76	4.16	
50,000	9.63	4.29	
52,000	9.57	4.35	
54,000	9.54	4.38	Inside coil closed down. Outside coil not closed down.
56,000	9.54—	4.38+	
54,000	9.54	4.38	
52,000	9.54	4.38	
50,000	9.59	4.33	
48,000	9.67	4.25	
46,000	9.78	4.14	
44,000	9.90	4.02	
42,000	10.04	3.88	
40,000	10.17	3.75	
38,000	10.30	3.62	
36,000	10.46	3.46	
34,000	10.60	3.32	
32,000	10.74	3.18	
30,000	10.88	3.04	
28,000	11.02	2.90	
26,000	11.18	2.74	
24,000	11.33	2.59	
22,000	11.48	2.44	
20,000	11.64	2.28	
18,000	11.79	2.13	
20,000	11.66	2.26	
30,000	10.96	2.96	
40,000	10.23	3.69	
50,000	9.60	4.32	
52,000	9.55	4.37	
54,000	9.54	4.38	
52,000	9.55	4.37	
50,000	9.58	4.34	
40,000	10.16	3.76	
30,000	10.87	3.05	
20,000	11.62	2.30	
18,000	11.78	2.14	
17,000	11.85	2.07	
16,000	11.93	1.99	
15,000	12.02	1.90	
14,000	12.11	1.81	
13,000	12.19	1.73	
12,540	12.25	1.67	
10,000	12.47	1.45	
8,000	12.66	1.26	
6,000	12.87	1.05	

No. 8324—Continued.

Applied loads.	Total height.	Compression.	Remarks.
Pounds.	*Inches.*	*Inches.*	
4,000	13.11	.81	
2,000	13.36	.56	
4,000	13.16	.76	
6,000	12.98	.94	
8,000	12.80	1.12	
10,000	12.64	1.28	
12,000	12.49	1.43	
14,000	12.34	1.58	
15,000	12.26	1.66	
15,180	12.25	1.67	
16,000	12.19	1.73	
18,000	12.09	1.88	
50,000	9.60	4.32	
18,000	11.79	2.13	Test discontinued.

Compression of the Outside Coil of Spring No. 8324.

Applied loads.	Total height.	Compression.	Remarks.
Pounds.	*Inches.*	*Inches.*	
2,000	13.42	0.50	
3,000	13.24	.68	
4,000	13.06	.86	
5,000	12.89	1.03	
6,000	12.71	1.21	
7,000	12.54	1.38	
8,000	12.39	1.53	
9,000	12.23	1.69	
10,000	12.09	1.83	
11,000	11.95	1.97	
12,000	11.80	2.12	
13,000	11.67	2.25	
14,000	11.51	2.41	
15,000	11.38	2.54	
16,000	11.23	2.69	
17,000	11.08	2.84	
18,000	10.93	2.99	
19,000	10.78	3.14	
20,000	10.62	3.30	
21,000	10.47	3.45	
22,000	10.30	3.62	
23,000	10.15	3.77	
24,000	10.00	3.92	
25,000	9.85	4.07	
26,000	9.69	4.23	
26,800	9.56	4.36	
26,000	9.65	4.27	
25,000	9.78	4.14	
24,000	9.89	4.03	
23,000	10.01	3.91	
22,000	10.14	3.78	
21,000	10.28	3.64	
20,000	10.40	3.52	
19,000	10.54	3.38	
18,000	10.68	3.24	
17,000	10.82	3.10	
16,000	10.97	2.95	
15,000	11.10	2.82	
14,000	11.24	2.68	
13,000	11.39	2.53	
12,000	11.52	2.40	
11,000	11.68	2.24	
10,000	11.82	2.10	
9,000	11.97	1.95	
8,000	12.14	1.78	
7,000	12.30	1.62	
6,000	12.48	1.44	
5,000	12.68	1.24	
4,000	12.88	1.04	
3,000	13.08	.84	
2,000	13.30	.62	

COMPRESSION OF THE INSIDE COIL OF SPRING NO. 8324.

Applied loads.	Total height.	Compression.	Remarks.
Pounds.	*Inches.*	*Inches.*	
500	13.33	0.27	
1,000	13.21	.39	
2,000	13.03	.57	
3,000	12.88	.72	
4,000	12.72	.88	
5,000	12.57	1.03	
6,000	12.41	1.19	
7,000	12.27	1.33	
8,000	12.11	1.49	
9,000	11.96	1.64	
10,000	11.80	1.80	
11,000	11.65	1.95	
12,000	11.49	2.11	
13,000	11.33	2.27	
14,000	11.17	2.43	
15,000	10.99	2.61	
16,000	10.82	2.78	
17,000	10.64	2.96	
18,000	10.47	3.13	
19,000	10.28	3.32	
20,000	10.08	3.52	
21,000	9.91	3.69	
22,000	9.74	3.86	
22,500	9.68	3.92	
23,000	9.61	3.99	
23,500	9.59	4.33	
23,000	9.60	4.32	
22,000	9.69	3.91	
21,000	9.80	3.80	
20,000	9.93	3.67	
19,000	10.08	3.54	
18,000	10.21	3.39	
17,000	10.37	3.23	
16,000	10.51	3.09	
15,000	10.66	2.94	
14,000	10.81	2.79	
13,000	10.98	2.62	
12,000	11.12	2.48	
11,000	11.28	2.32	
10,000	11.44	2.16	
9,000	11.60	2.00	
8,000	11.77	1.83	
7,000	11.95	1.65	
6,000	12.11	1.49	
5,000	12.30	1.30	
4,000	12.48	1.12	
3,000	12.68	.92	
2,000	12.89	.71	
1,000	13.12	.48	
500	13.24	.36	

RETEST OF 4 SPRINGS WHICH WERE CLOSED DOWN AND KEPT LOADED 64 HOURS.

Applied loads.	Height of springs.			
	First.	Second.	Third.	Fourth.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1,000	13.84	13.64	13.67	13.54
16,600	.....	.....	.....	12.25
17,760	.....	12.25	.....	.....
18,000	12.39	12.23	12.33	12.16
19,350	.....	.....	12.25	.....
19,970	12.25	.....	.....	.....
40,000	10.80	10.64	10.68	10.43
50,000	10.04	9.89	9.90	9.79
51,000	9.97	9.83	9.86	9.75
52,000	9.89	9.78	9.81	9.74
53,000	9.82	9.74	9.79	9.72
54,000	9.78	9.72	9.75	9.71
55,000	9.74	9.71	9.73	.....
56,000	9.72	.....	.....	.....
57,000	9.71	.....	.....	.....
52,000	9.83	9.75	9.78	9.72
50,000	9.95	9.83	9.83	9.74
49,000	.....	.....	.....	9.77
48,000	.....	.....	.....	9.80
47,000	.....	.....	.....	9.83
46,000	.....	.....	.....	9.88
45,000	.....	.....	.....	9.92
44,000	.....	.....	.....	9.98
40,000	10.59	10.44	10.43	10.23
18,000	12.14	11.98	12.02	11.84
16,630	12.25	.....	.....	.....
15,240	.....	.....	12.25	.....
14,590	.....	12.25	.....	.....
12,960	.....	.....	.....	12.25
18,000	12.16	12.01	12.06	.....
40,000	10.67	10.51	10.51	10.31
50,000	9.98	9.85	9.86	9.77
54,000	9.76	.....	.....	.....
55,000	9.73	.....	.....	.....
50,000	9.94	.....	.....	.....
40,000	10.59	10.45	10.46	10.24
18,000	12.12	11.98	12.01	11.82
16,300	12.25	.....	.....	.....
1,000	13.73	.....	.....	.....
14,380	.....	12.25	.....	.....
1,000	.....	13.60	.....	.....
15,080	.....	.....	12.25	.....
1,000	.....	.....	13.61	.....
12,800	.....	.....	.....	12.25
1,000	.....	.....	.....	13.44

TESTS OF SPRINGS NOT PREVIOUSLY LOADED.

Applied loads.	Height of springs.						
	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.	Eleventh.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1,000	13.62	13.68	13.90	13.71	13.62	13.43	13.68
16,220	.....	.....	.....	.....	.....	12.25	.....
17,670	.....	.....	.....	.....	12.25	.....	.....
18,000	12.26	12.32	12.50	12.34	12.22	12.11	12.31
18,290	12.25	.....	.....	.....	.....	.....	.....
18,890	.....	.....	.....	.....	.....	.....	12.25
19,150	.....	.....	.....	12.25	.....	.....	.....
21,550	.....	.....	12.25	.....	.....	.....	.....
52,500	.....	.....	.....	.....	.....	9.70	.....
53,500	.....	9.72	.....	9.70	.....	.....	.....
55,000	9.69	.....	.....	.....	9.70	.....	.....
56,000	.....	.....	9.69	.....	.....	.....	.....
62,000	.....	.....	.....	.....	.....	.....	9.59
18,000	12.00	12.03	12.09	12.00	11.92	11.77	11.92
15,900	.....	.....	12.25	.....	.....	.....	.....
15,080	.....	12.25	.....	.....	.....	.....	.....
14,740	.....	.....	.....	12.25	.....	.....	.....
14,620	12.25	.....	.....	.....	.....	.....	.....
14,000	.....	.....	.....	.....	12.25	.....	.....
13,940	.....	.....	.....	.....	.....	.....	12.25
a 12,040	.....	.....	.....	.....	.....	12.25	.....
b 12,180	.....	.....	.....	.....	.....	12.25	.....

a Load left acting 16 hours.
b Load necessary to compress spring to 12″.25 height at end of 16 hours.

COMPRESSION TESTS OF HELICAL SPRINGS FOR 12-INCH GUN LIFT CARRIAGE.

Springs consist of two coils each, the bars being coiled in opposite directions.

Dimension of springs.

Outside coil:		
Weight	pounds	13¼
Height	inches	5.40
Exterior diameter	do	5.79
Diameter of wire	do	1.00
Distance between coils	do	.50
Inside coil:		
Weight	pounds	5½
Height	inches	5.33
Exterior diameter	do	3.55
Diameter of wire	do	.75
Distance between coils	do	.30

Total weight of spring, 18¾ pounds.

Springs branded { "2 96
A French Spring Co ☞ G E"

Applied loads.	Height of springs.			
	No. 8387.	No. 8388.	No. 8389.	No. 8390.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
100	5.29	5.30	5.38	5.35
200	5.28	5.27	5.36	5.33
300	5.26	5.24	5.34	5.31
400	5.24	5.21	5.32	5.30
600	5.21	5.19	5.30	5.28
1,000	5.17	5.13	5.26	5.22
2,000	5.05	5.04	5.15	5.11
3,000	4.96	4.95	5.03	5.00
4,000	4.87	4.84	4.94	4.91
5,000	4.76	4.75	4.84	4.80
6,000	4.66	4.65	4.73	4.71
7,000	4.56	4.55	4.63	4.60
8,000	4.45	4.46	4.53	4.50
9,000	4.36	4.36	4.42	4.40
10,000	4.27	4.27	4.32	4.30
11,000	4.17	4.17	4.22	4.20
12,000	4.08	4.11	4.18	4.14
13,000	4.06	4.07	4.16	4.13
14,000	4.05	4.06	4.15	4.12
10,000	4.23	4.22	4.29	4.28
8,000	4.42	4.41	4.48	4.47
6,000	4.60	4.60	4.68	4.66
4,000	4.80	4.80	4.88	4.86
2,000	5.02	5.00	5.10	5.08
1,000	5.14	5.12	5.21	5.19
100	5.29	5.29	5.37	5.33

COMPRESSION TESTS OF HELICAL SPRINGS FOR 7-INCH MORTAR CARRIAGES.

Description of one spring.

Weight ..... 6 lbs. 1½ oz.
Height ..... 8″.21
Exterior diameter ..... 4″.41
Interior department ..... 3″.35
Diameter of wire ..... ″.56
Distance between coils ..... ″.70

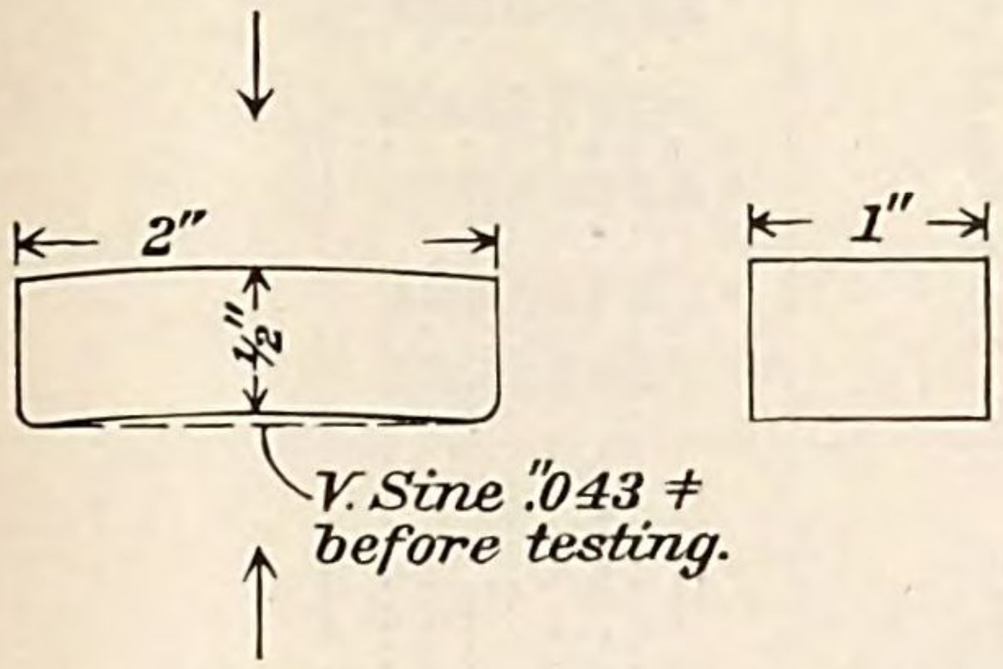
No. of spring.	Height free.	Load sustained.		Height closed.	Load when returned to 6″ high.	Remarks.
		When 6″ high.	When 4⅛″ high.			
	Inches.	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	
1	8.21	856	1,700	4⅛	790	
.....	.....	790	.....	.....	.....	Second application of load.
2	8.15	851	1,595	4⅛	800	
3	8.25	910	1,700	4⅛	866	
4	8.15	852	1,655	4⅛	810	
5	8.08	812	1,750	4⅛	795	
6	8.13	836	.....	4.15	795	
7	8.12	804	1,700	4⅛	798	
8	8.20	838	1,650	4⅛	792	
9	8.23	892	1,680	4⅛	870	
10	8.27	884	1,800	4⅛	842	
11	8.36	956	1,750	4⅛	854	
12	8.22	896	1,790	4⅛	876	
						Spring loaded 100 times, compressing to 4.″25 height, and releasing to 6″ height each time.
.....	.....	778	.....	.....	.....	After complete release of load and upon reapplication.
13	8.25	839	1,650	4⅛	802	
						Spring compressed to 4.″25 height ten times, releasing to 6″ height between each loading; then recovered to 776 pounds.
.....	.....	.....	.....	.....	776	
.....	.....	.....	.....	.....	766	After 10 additional compressions as above.

Spring No. 13 was now closed down, and thus remained a period of 15 hours. When released to 6″ high it sustained 746 pounds. Load released and immediately reapplied. The spring when 6″ high now sustained 788 pounds.

Compression Tests of Steel Springs.

No. 8362.

Tool steel.



Under 73,100 pounds compression the spring was nearly closed down; light barely perceptible between spring and buttress. Under 95,400 pounds compression the spring was fully closed down.

V. sine after loading once as above, ".027.

Loaded with 95,400 pounds compression ten times, after which the V. sine was ".023, thus showing a permanent set of ".020.

No. 8367.

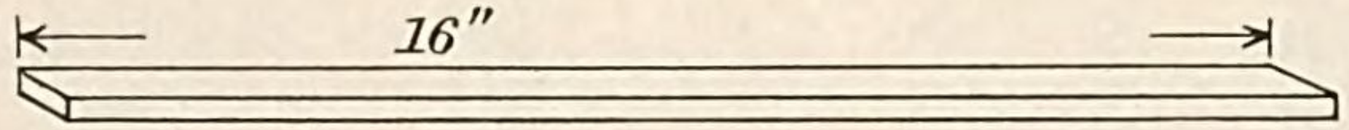
Spring steel.

V. sine before testing, ".04.

Under 60,800 pounds the spring fractured. There were two principal fragments and four smaller ones.

The fractures were fine granular.

STEEL PLATE FROM BERLIN IRON BRIDGE COMPANY.



No. of test.	Dimensions in inches.		Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
	Width.	Thickness.		Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
			Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			″ ″ *Sq. in.*	*Per ct.*		″ ″ ″ ″ ″ ″ ″ ″
9337	0.993	0.245	0.243	10,140	41,730	14,410	59,300	2.03	25.4	.72×.14=.101	58.4	Silky	.26, .55, *.24, .20, .22, .19, .20, .17
9338	.990	.249	.246	10,020	40,730	14,310	58,170	2.11	26.4	.70×.15=.105	57.3	do	.19, .20, .20, .21, .22, .24, .29, .56*
9339	.996	.381	.379	16,180	42,670	23,380	61,690	2.07	25.9	.70×.23=.161	57.5	Silky; seamy surface	.20, .22, .24, .60, *.24, .20, .19, .18
9340	.996	.380	.378	15,990	42,300	23,120	61,160	2.33	29.1	.70×.24=.168	55.5	Silky	.22, .22, .23, .22, .29, .29, .62, *.24
9341	1.003	.486	.487	19,150	39,320	29,940	61,480	2.27	28.4	.68×.28=.190	61.0	do	.23, .24, .25, .25, .22, .20, .25, .63*
9342	1.001	.484	.484	19,580	40,450	29,700	61,360	2.12	26.5	.67×.30=.201	58.4	do	.20, .22, .23, .22, .21, .18, .24, .62*
9343	.996	.714	.711	19,100	26,860	38,100	53,590	2.68	33.5	.64×.36=.230	67.7	do	.26, .22, .24, .27, .29, .32, .30, .78*
9344	1.011	.714	.722	18,950	26,250	38,050	52,700	2.40	30.0	.60×.40=.240	66.8	do	.20, .21, .20, .23, .30, .78, *.26, .22

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY.

CUPOLA IRON.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY—CUPOLA IRON.

The mixtures for the following specimens, five experimental casts, consisted of steel scrap, a soft pig iron, and an alloy added for the purpose of producing the desired chemical composition.

Specimens Nos. 5250, 5253, and 5254 from these heats, were poured before the alloy was added.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
September 12, 1895	Steel scrap	1,200	Cupola	5249
	Soft pig	1,800		5250
	Total	3,000		5463
September 14, 1895	Steel scrap	1,320	Cupola	5253
	Soft pig	1,800		5464
	Total	3,120		
September 17, 1895	Steel scrap	2,000	Cupola	5254
	Silicon pig	200		5465
	Total	2,200		
September 19, 1895	Steel scrap	1,200	Cupola	5466
	Soft pig	1,800		
	Total	3,000		
September 25, 1895	Steel scrap	2,000	Cupola	5256
	Watervliet pig	3,000		5467
	Total	5,000		

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 12, 1895.

No. 5463.

Marks, No. 837.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00007	.00007	----------	----------	
3,000	3,000	.00010	.00003	----------	----------	
4,000	4,000	.00016	.00006	----------	----------	
5,000	5,000	.00021	.00005	0.	----------	
6,000	6,000	.00028	.00007	----------	----------	
7,000	7,000	.00035	.00007	----------	----------	
8,000	8,000	.00040	.00005	----------	----------	
9,000	9,000	.00048	.00008	----------	----------	
10,000	10,000	.00053	.00005	0.	----------	
11,000	11,000	.00061	.00008	----------	----------	
12,000	12,000	.00070	.00009	----------	----------	
13,000	13,000	.00079	.00009	----------	----------	
14,000	14,000	.00087	.00008	----------	----------	
15,000	15,000	.00098	.00011	----------	----------	
16,000	16,000	.00107	.00009	----------	----------	
17,000	17,000	.00119	.00012	----------	----------	
18,000	18,000	.00130	.00011	----------	----------	
19,000	19,000	.00144	.00014	----------	----------	
20,000	20,000	.00161	.00017	----------	----------	
21,000	21,000	.00179	.00018	----------	----------	
22,000	22,000	.00200	.00021	----------	----------	
23,000	23,000	.00228	.00028	----------	----------	
24,000	24,000	.00260	.00032	----------	----------	
25,000	25,000	.00290	.00030	----------	----------	
26,000	26,000	.00335	.00045	----------	----------	
26,980	26,980	----------	----------	----------	----------	Tensile strength.

Fractured at the neck. Appearance fine granular, gray.
Specific gravity, 7.2326.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 14, 1895.

No. 5464.

Marks, No. 838.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	.....	.....	
3,000	3,000	.00010	.00005	.....	.....	
4,000	4,000	.00015	.00005	.....	.....	
5,000	5,000	.00021	.00006	—.00001	—.00001	
6,000	6,000	.00026	.00005	.....	.....	
7,000	7,000	.00033	.00007	.....	.....	
8,000	8,000	.00038	.00005	.....	.....	
9,000	9,000	.00045	.00007	.....	.....	
10,000	10,000	.00052	.00007	0.	.00001	
11,000	11,000	.00059	.00007	.....	.....	
12,000	12,000	.00067	.00008	.....	.....	
13,000	13,000	.00076	.00009	.....	.....	
14,000	14,000	.00083	.00007	.....	.....	
15,000	15,000	.00091	.00008	.00008	.00008	
16,000	16,000	.00101	.00010	.....	.....	
17,000	17,000	.00111	,00010	.....	.....	
18,000	18,000	.00122	.00011	.....	.....	
19,000	19,000	.00135	.00013	.....	.....	
20,000	20,000	.00150	.00015	.00024	.00016	
21,000	21,000	.00168	.00018	.....	.....	
22,000	22,000	.00182	.00014	.....	.....	
23,000	23,000	.00200	.00018	.....	.....	
24,000	24,000	.00230	.00030	.....	.....	
25,000	25,000	.00255	.00025	.00083	.00059	
26,000	26,000	.00299	.00044	.....	.....	
27,000	27,000	.00341	.00042	.....	.....	
28,000	28,000	.00400	.00059	.....	.....	
29,000	29,000	.00468	.00068	.....	.....	
30,000	30,000	.00560	.00092	.00325	.00242	
5,000	5,000	.00350	—.00210	.....	.....	
10,000	10,000	.00387	.00037	.....	.....	
15,000	15,000	.00425	.00038	.....	.....	
20,000	20,000	.00467	.00042	.....	.....	
25,000	25,000	.00511	.00044	.....	.....	
20,000	20,000	.00477	—.00034	.....	.....	
15,000	15,000	.00440	—.00037	.....	.....	
10,000	10,000	.00400	—.00040	.....	.....	
5,000	5,000	.00360	—.00049	.00323	—.00002	
30,000	30,000	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance fine granular, mottled.
Specific gravity, 7.2380.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 17, 1895.

No. 5465.

Marks, No. 839.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Sucessive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00005	.00005	----------	----------	
3,000	3,000	.00009	.00004	----------	----------	
4,000	4,000	.00014	.00005	----------	----------	
5,000	5,000	.00019	.00005	0.	----------	
6,000	6,000	.00023	.00004	----------	----------	
7,000	7,000	.00030	.00007	----------	----------	
8,000	8,000	.00035	.00005	----------	----------	
9,000	9,000	.00039	.00004	----------	----------	
10,000	10,000	.00045	.00006	0.	----------	
11,000	11,000	.00049	.00004	----------	----------	
12,000	12,000	.00055	.00006	----------	----------	
13,000	13,000	.00060	.00005	----------	----------	
14,000	14,000	.00067	.00007	----------	----------	
15,000	15,000	.00071	.00004	.00003	.00003	
16,000	16,000	.00079	.00008	----------	----------	
17,000	17,000	.00085	.00006	----------	----------	
18,000	18,000	.00090	.00005	----------	----------	
19,000	19,000	.00098	.00008	----------	----------	
20,000	20,000	.00104	.00006	.00009	.00006	
21,000	21,000	.00111	.00007	----------	----------	
22,000	22,000	.00119	.00008	----------	----------	
23,000	23,000	.00128	.00009	----------	----------	
24,000	24,000	.00135	.00007	----------	----------	
25,000	25,000	.00144	.00009	.00020	.00011	
26,000	26,000	.00154	.00010	----------	----------	
27,000	27,000	.00165	.00011	----------	----------	
28,000	28,000	.00178	.00013	----------	----------	
29,000	29,000	.00189	.00011	----------	----------	
30,000	30,000	.00204	.00015	.00048	.00028	
31,000	31,000	.00221	.00017	----------	----------	
32,000	32,000	.00241	00020	----------	----------	
33,000	33,000	.00262	.00021	----------	----------	
34,000	34,000	.00288	00026	----------	----------	
35,000	35,000	.00319	.00031	.00124	.00076	
37,620	37,620	----------	----------	----------	----------	Tensile strength.

Fractured at the neck. Appearance fine granular, granitic.
Specific gravity, 7.3455.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 19, 1895.

No. 5466.

Marks, No. 840.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00011	.00005	.....	.....	
4,000	4,000	.00017	.00006	.....	.....	
5,000	5,000	.00021	.00004	0.	.....	
6,000	6,000	.00028	.00007	.....	.....	
7,000	7,000	.00035	.00007	.....	.....	
8,000	8,000	.00041	.00006	.....	.....	
9,000	9,000	.00047	.00006	.....	.....	
10,000	10,000	.00053	.00006	.00002	.00002	
11,000	11,000	.00061	.00008	.....	.....	
12,000	12,000	.00070	.00009	.....	.....	
13,000	13,000	.00078	.00008	.....	.....	
14,000	14,000	.00086	.00008	.....	.....	
15,000	15,000	.00093	.00007	.00010	.00008	
16,000	16,000	.00103	.00010	.....	.....	
17,000	17,000	.00113	.00010	.....	.....	
18,000	18,000	.00122	.00009	.....	.....	
19,000	19,000	.00137	.00015	.....	.....	
20,000	20,000	.00150	.00013	.00029	.00019	
21,000	21,000	.00166	.00016	.....	.....	
22,000	22,000	.00182	.00016	.....	.....	
23,000	23,000	.00205	.00023	.....	.....	
24,000	24,000	.00230	.00025	.....	.....	
25,000	25,000	.00254	.00024	.00090	.00061	
26,000	26,000	.00280	.00026	.....	.....	
27,000	27,000	.00325	.00045	.00141	.00051	
31,990	31,990	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance fine granular, light gray.
Specific gravity, 7.2241.

STEEL MIXTURE WITH ALLOY. CAST SEPTEMBER 25, 1895.

No. 5467.

Marks, No. 842.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00008	.00008	----------	----------	
3,000	3,000	.00012	.00004	----------	----------	
4,000	4,000	.00018	.00006	----------	----------	
5,000	5,000	.00022	.00004	0.	----------	
6,000	6,000	.00028	.00006	----------	----------	
7,000	7,000	.00033	.00005	----------	----------	
8,000	8,000	.00038	.00005	----------	----------	
9,000	9,000	.00043	.00005	----------	----------	
10,000	10,000	.00048	.00005	.00001	.00001	
11,000	11,000	.00053	.00005	----------	----------	
12,000	12,000	.00058	.00005	----------	----------	
13,000	13,000	.00063	.00005	----------	----------	
14,000	14,000	.00069	.00006	----------	----------	
15,000	15,000	.00075	.00006	.00006	.00005	
16,000	16,000	.00080	.00005	----------	----------	
17,000	17,000	.00088	.00008	----------	----------	
18,000	18,000	.00093	.00005	----------	----------	
19,000	19,000	.00099	.00006	----------	----------	
20,000	20,000	.00104	.00005	.00008	.00002	
20,000	20,000	----------	----------	----------	----------	Tensile strength.

Fractured at the neck. Appearance fine granular, light granitic. Fractured on the second application of load after determining the permanent set caused by the first loading.

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY

AND

PIG IRONS.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY AND PIG IRONS.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches in diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows:

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
July 2, 1895	Muirkirk pig No. 4, high	4,000	Air furnace	5225
	Muirkirk pig No. 4, low	4,000		
	Katahdin pig	4,000		
	Soft pig	5,000		
	Remelted pig	5,000		
	Total	22,000		
	Muirkirk pig No. 4, high	3,000	Cupola	
	Muirkirk pig No. 4, low	3,000		
	Katahdin pig	1,500		
	Watervliet pig	5,000		
	Heads	3,500		
	10-inch shell	3,500		
	Scrap	1,000		
	Total	20,500		
July 8, 1895	Muirkirk pig No. 4, high	1,800	do	5226
	Muirkirk pig No. 4, low	1,800		
	Katahdin pig	1,200		
	Watervliet pig	4,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	3,000		
	Total	16,800		
July 12, 1895	Muirkirk pig No. 4, high	1,800	do	5227
	Muirkirk pig No. 4, low	1,800		
	Katahdin pig	1,200		
	Watervliet pig	4,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	3,000		
	Total	16,800		
July 17, 1895	Muirkirk pig No. 4, high	1,800	do	5228
	Muirkirk pig No. 4, low	1,800		
	Katahdin pig	1,200		
	Watervliet pig	4,000		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	3,200		
	Total	18,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
July 25, 1895	Muirkirk pig No. 4, high	600	Cupola	5230
	Muirkirk pig No. 4, low	600		
	Katahdin pig	1,200		
	Watervliet pig	2,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	3,600		
	Total	13,000		
July 30, 1895	Muirkirk pig No. 4, high	1,800	....do	5231
	Muirkirk pig No. 4, low	1,200		
	Watervliet pig	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scraps	2,500		
	Total	14,000		
August 3, 1895	Muirkirk pig No. 4, low	1,800	....do	5232
	Katahdin pig	1,200		
	Watervliet pig	2,500		
	Heads	2,500		
	10-inch shell	2,500		
	Scrap	2,500		
	Total	13,000		
August 8, 1895	Muirkirk pig No. 4, low	2,400	....do	5237
	Katahdin pig	1,200		
	Watervliet pig	3,500		
	Platform scrap	6,000		
	Heads	2,500		
	10-inch shell	2,500		
	Scrap	1,500		
	Total	19,600		
August 13, 1895	Muirkirk pig No. 4, low	1,800	....do	5240
	Katahdin pig	1,200		
	Watervliet pig	2,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,000		
	Total	11,000		
August 19, 1895	Muirkirk pig No. 4, low	1,800	....do	5242
	Katahdin pig	1,200		
	Watervliet pig	2,500		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	1,000		
	Total	11,000		
August 23, 1895	Muirkirk pig No. 4, low	1,800	....do	5243
	Katahdin pig	1,200		
	Watervliet pig	2,000		
	Heads	2,500		
	10-inch shell	2,500		
	Scrap	2,000		
	Total	12,000		
August 28, 1895	Muirkirk pig No. 4, low	1,800	....do	5244
	Katahdin pig	1,000		
	Watervliet pig	2,000		
	Heads	2,500		
	10-inch shell	2,500		
	Total	9,800		
September 7, 1895	Muirkirk pig No. 4, low	2,000	....do	5248
	Katahdin pig	1,500		
	Watervliet pig	3,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	500		
	Total	12,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
September 30, 1895	Muirkirk pig No. 4, low	2,000	Cupola	5257
	Watervliet pig	2,500		
	Heads	2,500		
	10-inch shell	3,000		
	Scrap	2,000		
	Total	12,000		
October 3, 1895	Muirkirk pig No. 4, low	1,500	....do	5258
	Watervliet pig	3,500		
	Heads	1,500		
	10-inch shell	1,000		
	Scrap	2,500		
	Total	10,000		
October 16, 1895	Muirkirk pig No. 4, low	1,000	....do	5260
	Watervliet pig	3,500		
	Heads	3,000		
	10-inch shell	2,500		
	Total	10,000		
October 25, 1895	Muirkirk pig No. 4, low	600	....do	5262
	Watervliet pig	1,400		
	Soft pig	1,000		
	Scrap	9,000		
	Total	12,000		
November 5, 1895	Muirkirk pig No. 4, high	1,000	....do	5264
	Muirkirk pig No. 4, low	1,000		
	Watervliet pig	2,000		
	Heads	2,000		
	Scrap	6,000		
	Total	12,000		
November 15, 1895	Muirkirk pig No. 4, high	2,000	....do	5265
	Watervliet pig	3,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	2,000		
	Total	12,000		
November 23, 1895	Muirkirk pig No. 4, high	1,000	....do	5267
	Watervliet pig	1,000		
	Heads	2,000		
	Scrap	11,000		
	Total	15,000		
December 5, 1895	Muirkirk pig No. 4, low	500	....do	5286
	Heads	1,500		
	10-inch shell	1,500		
	Scrap	10,500		
	Total	14,000		
December 7, 1895	Muirkirk pig No. 4, low	2,500	....do	5287
	Muirkirk pig No. 4, high	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Watervliet pig	2,000		
	Scrap	4,000		
	Total	17,000		
December 12, 1895	Muirkirk pig No. 4, low	3,000	....do	5288
	Heads	3,000		
	10-inch shell	3,000		
	Soft pig	500		
	Scrap	4,500		
	Total	14,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
December 27, 1895	Muirkirk pig No. 4, high	2,000	Cupola	5292, 5293
	Muirkirk pig No. 4, low	2,000		
	Heads	2,000		
	Scrap	6,000		
	Total	12,000		
December 31, 1895	Muirkirk pig No. 4, high	1,000	do	5295
	Muirkirk pig No. 4, low	1,000		
	Heads	2,500		
	10-inch shell	2,000		
	Scrap	3,500		
	Total	10,000		
January 4, 1896	Muirkirk pig No. 4, high	1,000	do	5296
	Muirkirk pig No. 4, low	1 000		
	Heads	1,000		
	10-inch shot	1,000		
	Scrap	6,000		
	Total	10,000		
January 11, 1896	Muirkirk pig No. 4, high	500	do	5298
	Muirkirk pig No. 4, low	1,000		
	Heads	2,000		
	10-inch shell	2,000		
	Scrap	2,500		
	Soft pig	1,000		
	Total	9,000		
January 20, 1896	Muirkirk pig No. 4, high	2,000	do	5301
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,500		
	Scrap	3,000		
	Total	13,000		
January 23, 1896	Muirkirk pig No. 4, high	2,000	do	5302
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	3,500		
	Total	14,000		
January 27, 1896	Muirkirk pig No. 4, high	2,000	do	5304
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	4,000		
	Total	14,500		
January 30, 1896	Muirkirk pig No. 4, high	2,000	do	5308
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,500		
	Scrap	4,000		
	Total	14,000		
February 3, 1896	Muirkirk pig No. 4, high	2,000	do	5309
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,500		
	Scrap	4,000		
	Total	14,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 6, 1896	Muirkirk pig No. 4, high	4,500	Air furnace	5316
	Muirkirk pig No. 4, low	4,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,000		
	Muirkirk pig No. 4, high	3,000	Cupola	5317
	Muirkirk pig No. 4, low	2,500		
	Soft pig	1,000		
	Heads	3,500		
	10-inch shell	2,500		
	Scrap	3,500		
	Total	16,000		
February 10, 1896	Muirkirk pig No. 4, high	2,000	do	5319
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,500		5320
	Scrap	4,000		
	Total	14,000		
February 20, 1896	Muirkirk pig	1,500	do	5323
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	3,500		
	Total	11,000		
February 25, 1896	Muirkirk pig No. 4, low	1,000	do	5324
	Salisbury pig No. 4, high	1,500		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,500		5325
	Scrap	3,000		
	Total	12,000		
March 3, 1896	Salisbury pig No. 4, high	1,500	do	5328
	Salisbury pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	3,000		
	12-inch shell	2,500		5333
	Scrap	5,500		
	Total	15,000		
March 10, 1896	Salisbury pig No. 4, high	1,500	do	5334
	Salisbury pig No. 4, low	1,500		
	Soft pig	1,000		
	Hea s	3,000		
	10-inch shell	2,500		5335
	Scrap	2,500		
	Total	12,000		
March 13, 1896	Muirkirk pig No. 4, high	2,000	do	5336
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Soft pig	1,000		
	Heads	2,000		
	Scrap	3,000		
	10-inch shell	3,000		
	Total	17,000		
March 27, 1896	Salisbury pig No. 4, high	2,500	do	5340
	Salisbury pig No. 4, low	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	6,000		
	Total	17,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
April 7, 1896	Salisbury pig No. 4, high	2,000	Cupola	5342
	Salisbury pig No. 4, low	2,000		
	Heads	3,500		
	10-inch spell	3,000		
	Scrap	8,500		
	Total	19,000		
April 14, 1896	Salisbury pig No. 4, high	2,000	....do	5343
	Salisbury pig No. 4, low	2,000		
	Heads	4,000		
	10-inch shell	3,000		
	Scrap	6,000		
	Total	17,000		
April 23, 1896	Salisbury pig No. 4, high	3,000	....do	5345
	Salisbury pig No. 4, low	3,000		
	Muirkirk pig No. 4, high	2,000		
	Heads	3,000		
	10-inch shell	2,500		
	Scrap	4,000		
	Total	17,500		
April 30, 1896	Muirkirk pig No. 4, high	2,000	....do	5346
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Heads	3,000		
	10-inch shell	3,500		
	Scrap	5,500		
	Total	20,000		
May 7, 1896	Salisbury pig No. 4, high	3,000	....do	5348, 5349
	Salisbury pig No. 4, low	2,000		
	Muirkirk pig No. 4, high	2,000		
	Heads	3,500		
	10-inch shell	2,500		
	Scrap	6,000		
	Total	19,000		
May 14, 1896	Salisbury pig No. 4, high	3,000	....do	5350
	Salisbury pig No. 4, low	2,000		
	Muirkirk pig No. 4, high	2,500		
	Heads	3,500		
	10-inch shell	2,500		
	Scrap	5,500		
	Total	19,000		
June 2, 1896	Salisbury pig No. 4, high	3,500	....do	5358
	Salisbury pig No. 4, low	3,000		
	Heads	4,200		
	10-inch shell	3,000		
	Scrap	2,800		
	Total	16,500		
June 8, 1896	Salisbury pig No. 4, high	4,000	....do	5363
	Salisbury pig No. 4, low	3,500		
	Heads	4,700		
	10-inch shell	2,500		
	Scrap	4,000		
	Total	18,700		
July 23, 1895	Muirkirk pig No. 4, high	3,600	Air furnace	5229
	Muirkirk pig No. 4, low	3,600		
	Katahdin pig	3,600		
	Soft pig	4,600		
	Remelted pig	4,600		
	Total	20,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
August 16, 1895	Muirkirk pig No. 4, high	3,600	Air furnace	5241
	Muirkirk pig No. 4, low	3,600		
	Katahdin pig	3,600		
	Soft pig	3,600		
	Remelted pig	3,600		
	Total	18,000		
	Muirkirk pig No. 4, low	1,500	Cupola	
	Muirkirk pig No. 4, high	1,500		
	Katahdin pig	2,000		
	Watervliet pig	4,000		
	Heads	3,500		
	10-inch shell	2,000		
	Total	14,500		
September 5, 1895	Muirkirk pig No. 4, high	3,600	Air furnace	5245
	Muirkirk pig No. 4, low	3,600		
	Katahdin pig	3,600		
	Soft pig	3,600		
	Remelted pig	3,600		
	Total	18,000		
	Muirkirk pig No. 4, high	1,500	Cupola	
	Muirkirk pig No. 4, low	1,500		
	Katahdin pig	1,500		
	Watervliet pig	3,500		
	Heads	3,500		
	10-inch shell	2,000		
	Total	13,500		
September 25, 1895	Muirkirk pig No. 4, high	4,000	Air furnace	5255
	Muirkirk pig No. 4, low	4,000		
	Katahdin pig	1,000		
	Soft pig	4,500		
	Remelted pig	4,500		
	Total	18,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Muirkirk pig No. 4, low	2,000		
	Watervliet pig	3,000		
	Steel scrap	2,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	1,000		
	Total	15,000		
October 12, 1895	Muirkirk pig No. 4, high	4,500	Air furnace	5259
	Muirkirk pig No. 4, low	4,500		
	Soft pig	4,500		
	Remelted pig	4,500		
	Total	18,000		
	Muirkirk pig No. 4, high	1,500	Cupola	
	Muirkirk pig No. 4, low	1,500		
	Watervliet pig	4,000		
	Heads	3,500		
	10-inch shell	2,000		
	Scrap	2,500		
	Total	15,000		
November 21, 1895	Muirkirk pig No. 4, high	6,000	Air furnace	5266
	Muirkirk pig No. 4, low	6,000		
	Soft pig	6,000		
	Remelted pig	6,000		
	Total	24,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
November 21, 1895	Muirkirk pig	2,000	Cupola	5266
	Watervliet pig	3,000		
	Heads	2,000		
	10-inch shell	2,000		
	Scrap	4,000		
	Total	13,000		
March 20, 1896	Mnirkirk pig No. 4, high	6,000	Air furnace	5339
	Salisbury pig No. 4, high	2,800		
	Salisbury pig No. 4, low	2,700		
	Soft pig	5,500		
	Remelted pig	5,500		
	Total	22,500		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4, low	2,200		
	Heads	3,500		
	10-inch shell	3,000		
	Scrap	6,500		
	Total	19,500		
April 21, 1896	Muirkirk pig No. 4, high	6,000	Air furnace	5344
	Salisbury pig No. 4, high	2,800		
	Salisbury pig No. 4, low	2,700		
	Soft pig	5,500		
	Remelted pig	5,000		
	Total	22,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4, low	2,200		
	Heads	3,500		
	10-inch shell	3,000		
	Scrap	6,500		
	Total	19,500		
May 21, 1896	Muirkirk pig No. 4, high	6,000	Air furnace	5351
	Salisbury pig No. 4, high	2,800		
	Salisbury pig No. 4, low	2,700		
	Soft pig	5,500		
	Remelted pig	5,000		
	Total	22,000		
	Muirkirk pig No. 4, high	3,000	Cupola	
	Salisbury pig No. 4, high	2,300		
	Salisbury pig No. 4, low	2,200		
	Heads	4,700		
	10-inch shell	3,500		
	Scrap	9,000		
	Total	24,700		
June 18, 1896	Muirkirk pig No. 4, high	6,000	Air furnace	5366
	Salisbury pig No. 4, high	2,800		
	Salisbury pig No. 4, low	2,700		
	Soft pig	5,500		
	Remelted pig	5,000		
	Total	22,000		
	Muirkirk pig No. 4, high	3,000	Cupola	
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Heads	4,200		
	10-inch shot	2,000		
	Scrap	2,500		
	Total	15,700		

Cast iron from Watertown Arsenal Foundry—Continued.

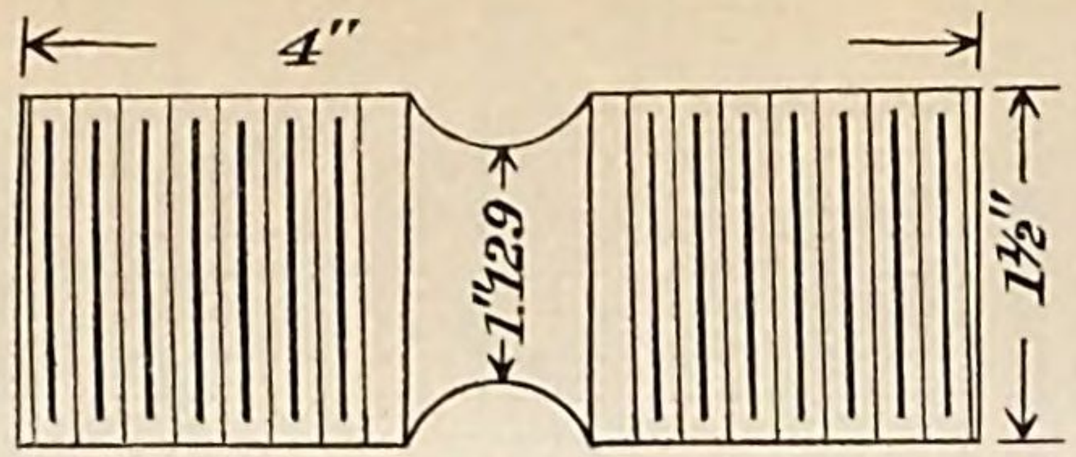
Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
October 29, 1895	Muirkirk pig No. 4, high	3,000	Cupola	5263
	Muirkirk pig No. 4, low	3,000		
	Watervliet pig	2,000		
	Heads	3,000		
	Scrap	3,000		
	Total	14,000		
April 23, 1896	Muirkirk pig No. 4, high	2,000	do	5345
	Salisbury pig No. 4, high	3,000		
	Salisbury pig No. 4, low	3,000		
	Heads	3,000		
	10-inch shell	2,500		
	Scrap	4,000		
	Total	17,500		
December 20, 1895	Muirkirk pig No. 4, high	2,500	do	5291
	Muirkirk pig No. 4, low	2,500		
	Watervliet pig	2,000		
	10-inch shell	3,000		
	Scrap	3,000		
	Heads	3,000		
	Total	16,000		
January 9, 1896	Muirkirk pig No. 4, high	2,500	do	5297
	Muirkirk pig No. 4, low	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	3,500		
	Total	14,500		
January 24, 1896	Muirkirk pig No. 4, high	2,500	do	5303
	Muirkirk pig No. 4, low	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	4,000		
	Total	15,000		
February 8, 1896	Muirkirk pig No. 4, high	2,500	do	5318
	Muirkirk pig No. 4, low	2,500		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	4,000		
	Total	15,000		
January 17, 1896	Muirkirk pig No, 4, high	4,500	Air furnace	5300
	Muirkirk pig No. 4, low	4,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,000		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Muirkirk pig No. 4, low	2,000		
	Soft pig	1,000		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	3,000		
	Total	13,000		
February 28, 1896	Muirkirk pig No. 4, high	4,500	Air furnace	5329
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,000		

Cast iron from Watertown Arsenal Foundry—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 28, 1896	Muirkirk pig No. 4, high	2,000	Cupola	5329
	Salisbury pig No. 4, high	3,000		
	Heads	3,000		
	10-inch shell	3,000		
	Scrap	5,000		
	Total	16,000		
March 31, 1896	Muirkirk pig No. 4, high	5,000	Air furnace	5341
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	2,000		
	Soft pig	3,000		
	Remelted pig	500		
	Total	12,500		
	Muirkirk pig No. 4, high	2,000	Cupola	
	Salisbury pig No. 4, high	2,000		
	Salisbury pig No. 4, low	1,500		
	Heads	3,000		
	10-inch shell	2,000		
	Scrap	2,000		
	Total	12,500		
January 15, 1896	Muirkirk pig No. 4, high	1,500	do	5299
	Muirkirk pig No. 4, low	1,500		
	Soft pig	1,000		
	Heads	1,500		
	10-inch shell	1,500		
	Scrap	2,500		
	Total	9,500		

Where two furnaces were used for one casting they were run together in the mold, and are represented by one tension test.

CAST IRON FROM WATERTOWN ARSENAL, AND PIG IRONS.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1895.									*Pounds.*			
5225	Segmental platform	July 2	.....	.....	.....	.....	.....	.....	.....	.....	34,580	Fine granular, light gray	7.2314	17.44
5226	12" shot, 7" and 12" shell	July 8	.....	.....	.....	.....	.....	.....	.....	.....	30,450	Fine granular, granitic	7.2370	16.23
5227	.....do	July 12	.....	.....	.....	.....	.....	.....	.....	.....	28,800	.....do	7.2407	17.08
5228	.....do	July 17	.....	.....	.....	.....	.....	.....	.....	.....	28,980	.....do	7.2172	16.81
5230	12" shot, 7" shell	July 25	.....	.....	.....	.....	.....	.....	.....	.....	28,790	.....do	7.2538	.....
5231	.....do	July 30	.....	.....	.....	.....	.....	.....	.....	.....	28,990	.....do	7.1920	.....
5232	.....do	Aug. 3	.....	.....	.....	.....	.....	.....	.....	.....	27,650	Fine granular	7.2251	.....
5237	.....do	Aug. 8	.....	.....	.....	.....	.....	.....	.....	.....	30,900	Fine granular, granitic	7.2124	.....
5240	.....do	Aug. 13	.....	.....	.....	.....	.....	.....	.....	.....	27,980	.....do	7.1262	.....
5242	.....do	Aug. 19	.....	.....	.....	.....	.....	.....	.....	.....	30,010	.....do	7.1957	.....
5243	.....do	Aug. 23	.....	.....	.....	.....	.....	.....	.....	.....	28,640	.....do	7.2361	.....
5244	.....do	Aug. 28	.....	.....	.....	.....	.....	.....	.....	.....	27,510	Fine granular	7.1947	.....
5248	.....do	Sept. 7	.....	.....	.....	.....	.....	.....	.....	.....	29,980	Fine granular, granitic	7.1877	.....
5249	12" shell with alloy, "steel mixture."	Sept. 12	2.934	2.146	0.894	0.450	1.184	0.090	0.541	0.000	31,600	Fine granular, gray	7.2124	.....
5250	12" shell without alloy, "steel mixture."	.....do ...	2.841	2.680	0.161	0.449	1.146	0.103	0.551	0.000	26,400	Fine granular, lighter gray	7.2773	.....
5253	12" shell without alloy	Sept. 14	2.994	2.099	0.895	0.450	1.100	0.093	0.560	0.000	33,610	Fine granular, gray	7.2667	.....
5254	.....do	.....do ...	2.727	1.818	0.909	0.426	0.865	0.146	0.514	0.000	32,300	Fine granular, light gray	7.2613	.....

Cast iron from Watertown Arsenal Foundry—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1895.									*Pounds.*			
5256	12″ shell with alloy	Sept. 25	2.413	1.303	1.110	0.458	1.222	0.134	0.504	0.000	28,500	Fine granular, light granitic	7.3222	
5257	12″ and 7″ shell, 12″ shot	Sept. 30									29,890	Fine granular, light gray	7.1855	
5258	7″ shell, 12″ shot and 8″ high explosive shell.	Oct. 3									29,410	do	7.1484	
5260	7″ and 8″ shell	Oct. 16									27,510	Fine granular, granitic	7.2246	
5262	do	Oct. 25									29,040	Fine granular, dark gray	7.1938	
5264	7″ shell	Nov. 5									27,980	Fine granular	7.1735	
5265	7″ shell, 12″ shot	Nov. 15									28,120	Fine granular, granitic	7.2269	
5267	7″ shell	Nov. 23									29,600	Fine granular	7.1928	
5286	do	Dec. 5									33,210	do	7.2184	
5287	do	Dec. 7									30,050	do	7.1868	
5288	7″ and 12″ shell	Dec. 12									25,450	Fine granular, dark gray, irregular surface.	7.1138	
5292	3″.2 shell	Dec. 27									27,220	Fine granular, dark gray	7.1986	
5294	do										29,270	Fine granular	7.1688	
5295	7″ shell	Dec. 31									30,710	Fine granular, granitic	7.1896	
		1896.												
5296	3″.2 shell	Jan. 4									28,100	do	7.2018	
5298	do	Jan. 11									21,400	Fine granular, dark gray	7.1045	
5301	do	Jan. 20									27,640	do	7.1501	
5302	12″ shot	Jan. 23									29,980	Fine granular, granitic	7.1613	
5304	3″.2 shell	Jan. 27									24,320	Fine granular, dark gray	7.1529	
5308	12″ shot	Jan. 30									31,100	Fine granular, granitic	7.2923	
5309	3″.2 shell	Feb. 3									23,980	Fine granular, gray	7.0781	
5316	12″ shot	Feb. 6									27,990	Granular, irregular surface	7.0846	
5319	3″.2 shell	Feb. 10									24,410	Fine granular, light gray	7.1470	
5320	12″ shot	do									29,850	Fine granular, granitic	7.1451	
5323	do	Feb. 20									32,020	do	7.1501	
5324	3″.2 shell	Feb. 25	3.272	2.784	0.488	0.451	1.692	0.120	0.554		33,460	Fine granular, light gray	7.1482	
5325	3″.2 shell specimen with 2″ stem, ″.564 diameter.	do	3.490	3.264	0.226	0.440	1.739	0.125	0.661		20,320	Medium granular, dark gray		
5328	3″.2 shell	Mar. 3									29,180	Fine granular, light gray	7.1878	
5333	12″ and 8″ shot	do									30,810	Fine granular, light gray, granitic	7.2479	
5334	8″ shot	Mar. 10									30,200	do	7.1494	
5335	3″.2 shell	do									18,950	Fine granular, 8 per cent spongy	7.0667	
5336	8″ shot	Mar. 13									31,980	Granular, light gray, granitic	7.1894	

5340	8″ shot, 12″ shell	Mar. 27									29,950	Granular, light gray, granite	7.1609	
5342	do	Apr. 7									28,110	Granular, granitic	7.1896	
5343	do	Apr. 14									31,060	do	7.1583	
5345	12″ shell, 8″ shot	Apr. 23									30,950	Granular, light gray	7.1819	
5346	12″ shell, 10″ shot	Apr. 30									31,450	do	7.1635	
5349	do	May 7									31,350	Granular, light gray	7.1129	
5350	do	May 14									29,990	do	7.2182	
5358	do	June 2									32,298	Fine granular, granitic	7.2066	
5363	do	June 8 1895.									34,080	Fine granular, light gray	7.184	
5229	Bottom roller path for 12″ mortar carriage.	July 23									30,510	Fine granular	7.1716	14.06
5241	do	Aug. 16									36,400	Fine granular, light gray, granitic	7.2753	
5245	do	Sept. 5									36,800	Fine granular, light gray		
5255	do	Sept. 25									36,020	do	7.2809	
5259	do	Oct. 12									35,680	Fine granular, light gray, slightly mottled.	7.2633	
5266	Top roller path, 12″ mortar carriage.	Nov. 21 1896.									36,020	Fine granular	7.2583	
5339	do	Mar. 20									35,410	Granular, light gray	7.2067	
5344	do	Apr. 21									33,900	Granular, gray	7.1467	
5351	do	May 21									34,050	Granular, light gray, silvery luster	7.1490	
5366	do	June 18 1895.									36,700	Fine granular, light gray	7.185	
5263	Side frame, 12″ mortar carriage	Oct. 29									31,280	Fine granular, dark gray	7.2128	
5254	Transom, 12″ mortar carriage.	Nov. 5									27,980	Fine granular		
5286	Side frame, 12″ mortar carriage	Dec. 5 1896.									33,210	do		
5345	do	Apr. 23									30,950	Granular, light gray	7.1819	
5346	do	Apr. 30									31,450	do		
5348	do	May 7									26,450	Granular, light and dark gray interspersed, spongy.	7.1428	
5349	do	do									31,350	Granular, light gray		
5363	do	June 8 1895.									34,080	Fine granular, light gray		
5287	Bottom roller path, 10″ disappearing carriage.	Dec. 7									30,050	Fine granular		
5291	do	Dec. 20 1896.									29,020	Fine granular, dark gray	7.1449	
5297	do	Jan. 9									29,810	Fine granular, granitic	7.1672	
5303	do	Jan. 24									31,160	do	7.1764	
5318	do	Feb. 8 1895									30,800	do	7.3188	
5293	Top 10″ disappearing carriage	Dec. 27 1896.									37,760	Fine granular, light gray	7.2734	
5300	do	Jan. 17									38,200	Fine granular, granitic	7.2755	
5317	do	Feb. 6									37,260	do	7.2252	
5329	do	Feb. 28									35,290	Fine granular, light gray; irregular surface.	7.2260	
5341	do	Mar. 31									36,040	Granular, light gray	7.2276	

Cast iron from Watertown Arsenal Foundry—Continued.

No. of test.	Description.	Date of cast.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
		1895.									*Pounds.*			
5299	Traverse circle, 10″ disappearing carriage.	Jan. 15	.....	.....	.....	.....	.....	.....	.....	.....	32,450	Fine granular, granitic	7.2376	.....
5302	.....do	Jan. 23	.....	.....	.....	.....	.....	.....	.....	.....	29,980	.....do	7.1613	.....
5308	.....do	Jan. 30	.....	.....	.....	.....	.....	.....	.....	.....	31,100	.....do	7.2923	.....
5316	.....do	Feb. 6	.....	.....	.....	.....	.....	.....	.....	.....	27,990	Granular, irregular surface	7.0846	.....
5320	.....do	Feb. 10	.....	.....	.....	.....	.....	.....	.....	.....	29,850	Fine granular, granitic	7.1451	.....
5333	.....do	Mar. 3	.....	.....	.....	.....	.....	.....	.....	.....	30,810	Fine granular, light gray, granitic	7.2479	.....
5334	.....do	Mar. 10	.....	.....	.....	.....	.....	.....	.....	.....	30,200	.....do	7.1494	.....
5336	.....do	Mar. 13	.....	.....	.....	.....	.....	.....	.....	.....	31,980	.....do	7.1894	.....
5340	.....do	Mar. 27	.....	.....	.....	.....	.....	.....	.....	.....	29,950	.....do	7.1609	.....
5350	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	29,990	Granular, light gray	7.2182	.....
5316	Stiffening bar, 10″ disappearing carriage.	Feb. 6	.....	.....	.....	.....	.....	.....	.....	.....	27,990	Granular, irregular surface	7.0846	.....
5336	Pintle plate	Mar. 13	.....	.....	.....	.....	.....	.....	.....	.....	31,980	Granular, light gray, granitic	7.1894	.....
	PIG IRONS.													
5238	Richmond charcoal No. 4	.....	.....	.....	.....	.....	.....	.....	.....	.....	18,900	Fine and medium fine granular metal interspersed.	.....	.....
5239	Richmond charcoal No. 4, high	.....	.....	.....	.....	.....	.....	.....	.....	.....	23,100	.....do	.....	.....
5246	Muirkirk No. 4, high	.....	.....	.....	.....	.....	.....	.....	.....	.....	31,250	Fine granular	7.2586	.....
5247	Muirkirk No. 4, low	.....	.....	.....	.....	.....	.....	.....	.....	.....	27,740	.....do	7.2593	.....
5251	.....do	.....	3.059	2.200	0.859	0.706	1.569	0.112	0.419	0.000	33,680	.....do	7.2794	.....
5252	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	37,990	.....do	7.3306	.....
5236	Rebecca No. 1, soft, American	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,320	Coarse and fine granular metal interspersed.	6.9909	.....
5268	Soft Clifton No. 1, coke	.....	4.205	2.893	1.312	0.200	2.045	0.015	0.476	0.010	10,980	Coarse granular; brilliant luster	.....	.....
5285	Watts Kentucky	.....	3.381	3.092	0.289	0.550	3.340	0.020	0.524	0.000	9,310	Very coarse granular; brilliant facets	.....	.....
5310	Salisbury No. 4, high	.....	.....	.....	.....	.....	.....	.....	.....	.....	26,720	Fine granular; light gray	7.2045	.....
5311	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	32,450	.....do	7.2531	.....
5312	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	30,590	Fine granular, coarser on one side; light gray.	7.2443	.....
5313	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	20,020	Fine granular, light gray	7.2348	.....
5321	.....do	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,120	.....do	7.2165	.....

5322	.....do									35,500	Fine granular, light gray	7.1507	
5352	.....do									26,500	.....do		
5354	.....do									22,180	Fine granular; dark gray	7.1830	
5355	.....do									27,310	.....do	7.1729	
5326	Salisbury No. 4, low									22,310	Granular, varying from medium fine to fine; dark gray.	7.2648	
5327	.....do									23,260	Fine granular, gray	7.2120	
5330	.....do									24,100	Medium fine to fine granular, light gray.	7.1197	
5353	.....do									17,500	Fine granular, dark gray		
5356	.....do									23,620	.....do	7.1585	
5357	.....do									21,240	Medium fine granular, dark gray	7.1215	
5359	.....do		3.530	2.838	0.692	0.750	1.257	0.050	0.179	23,800	Fine granular, varying in size of granulation.	7.1751	
5360	.....do									26,050	Fine granular	7.1984	
5361	.....do									20,790	.....do	7.1452	
5362	.....do									20,410	Fine granular, varying in size of granulalion.	7.1572	
5364	Copake No. 4, high		3.365	2.866	0.499	0.350	0.780	0.058	0.416	24,110	Fine granular, dark gray		
5365	.....do									19,900	.....do		

CHAIN CABLE AND CHAIN IRON

FROM

BUREAU OF EQUIPMENT, UNITED STATES NAVY-YARD, BOSTON, MASS.

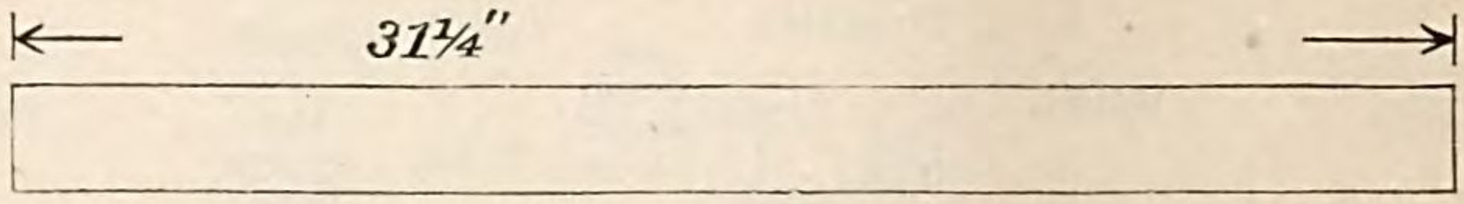
CHAIN CABLE.

[Samples consist of three studded links of chain each, with end links of larger diameter excepting Nos. 8354 and 8355, which contained two links of chain each.]

No. of test.	Brand on studs.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fracture.
			End links.	Links of chain.		Total.	Per square inch.	
			In.	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	
8191	U. S. N. Y. B	.....	2.68	2.52	9.97	373,900	37,500	End link in the quarter. Fibrous.
8191*a*	.....	.....	.....	.....	.....	440,500	44,180	Middle link of chain at the quarter weld and across the opposite side. Both fractures were granular. The fracture at the quarter weld radiated from a point in the circumference about 80 degrees from a diametrical plane, cutting the two sides of the link, and toward the inside of the link. The fracture across the side of the link radiated from a point in the circumference at the inside of the link.
8192	..... do	.....	2.75	2.53	10.05	408,900	40,690	End link in the quarter. Fibrous.
8192*a*	.....	.....	.....	.....	.....	439,200	43,700	Other end link in the quarter. Fibrous.
8192*b*	.....	.....	.....	.....	.....	449,500	44,730	Middle link of chain in the quarter. Silky. The link also fractured at the opposite welded end, with a granular appearance radiating from the inside of the link. The latter fracture was a secondary one.
8348	Steel chain U. S. N. Y. B. 1895.	.....	2.71	2.53	10.05	458,300	45,600	First link of the chain in the quarter. Silky. A secondary fracture occurred in the other quarter of the same end of the link, which presented a fine granular appearance radiating from a point at the inside of the link.
8349	U. S. N. Y. B.	.....	2.71	2.42	9.20	324,800	35,300	First link of chain in the quarter. Fibrous.
8352	.....	Iron	2.76	2.48	9.66	435,000	45,030	First link of chain in the weld.
8353	.....	Steel No. 1..	2.80	2.54	10.13	375,000	37,010	First link of chain in the quarter opposite the weld.
8354	.....	Steel No. 2..	2.77	2.54	10.13	374,600	36,980	First link of chain in the weld.
8355	.....	Steel No. 3..	2.77	2.54	10.13	400,200	39,510	First link of chain in the quarter opposite the weld. Silky.
8356	.....	Steel No. 4..	2.75	2.55	10.21	371,600	36,400	Middle link of chain in the weld. Fine granular.
8360	U. S. N. Y. B.	"Monongahela"	2.73	2.46	9.50	487,500	51,310	Middle link at welded end; also through opposite end. Link separated into three pieces. The fractures were all granular.
8365	U. S. 1895	.....	2.78	2.50	9.82	380,100	38,710	Middle link of chain in the quarter at the end opposite the weld. Fibrous.
8366	..... do	.....	2.78	2.51	9.90	387,600	38,150	Middle link of chain in the quarter at the end opposite the weld. Fibrous.

Sample No. 8360 had been strained with 380,000 pounds tension prior to the final test made at Watertown Arsenal.

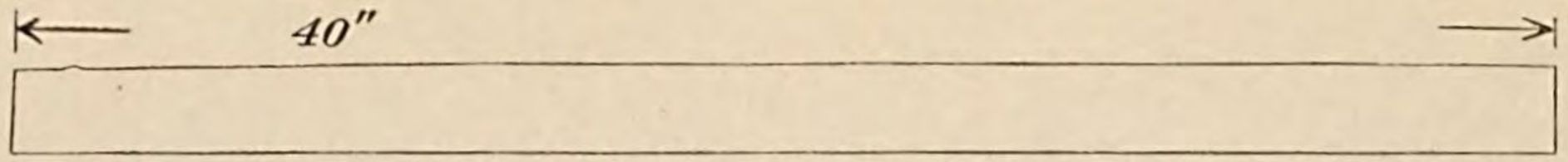
CHAIN IRON.



No. of test.	Diameter.	Sectional area.	Tensile strength.		Area at fracture.	Contraction of area.
			Total.	Per square inch.		
	Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Inches. Sq. in.*	*Per cent.*
8186	2.52	4.99	237,100	47,510	Diam. 1.90=2.84	43.1
8187	2.54	5.07	241,600	47,650	Diam. 1.87=2.75	45.8
8188	2.55	5.11	239,700	46,910	Diam. 1.86=2.72	46.8

Appearance of fractures, fibrous, laminated. At the center of each bar the metal was dull gray mingled with spots of lighter-colored metal.

CHAIN IRON.



No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 10 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
				Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inches. Sq. in.*	*Per ct.*		" " " " " " " " " "
8363	•	2.53	5.03	130,100	25,860	246,100	48,930	3.16	31.6	Diam. 1.88=2.78	44.7	Fibrous ..	.23, .24, .24, .25, .27, .28, .27, .28, .38, .72*
8364	• •	2.54	5.07	122,000	24,060	243,800	48,090	3.36	33.6	Diam. 1.97=3.05	39.8	....do	.36, .64,*.47, .31, .27, .26, .27, .26, .26, .26

BRONZE.

BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Composition ..... { Cu ..... per cent .. 57.5
Zn ..... do .... 42.
Sn ..... do 5

Specimens taken from coupons about $1\frac{1}{4}''$ by $1\frac{1}{8}''$, cast with and attached to the dry-sand castings which they represent.

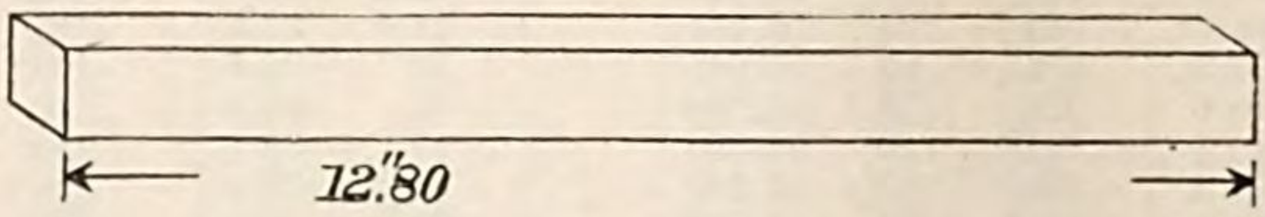
Description.	Diameter.	Sectional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length	Contraction of area.	Fracture.
	Inch.	*Sq. in.*	*Pounds.*	*Inches.*	*Per ct.*	*Per ct.*	
8″ loading tray No. 1..	0.564	0.25	55,120	2	43	39.2	Light-yellow color; fractured surface contains blowhole ″.02 diameter.
8″ loading tray No. 2..	.564	.25	46,080	2	16.5	21.6	Light-lavender colored, interspersed with spots of yellow metal.
8″ loading tray No. 3..	.564	.25	51,040	2	30.5	30.4	Light-yellow metal; fractured surface contains minute blowholes.
8″ loading tray No. 4..	.564	.25	52,160	2	47.5	42	Light-yellow metal; dark-brown spot ″.03 diameter.
8″ loading tray No. 5..	.564	.25	52,200	2	24	30.4	Uniform light-yellow metal.
8″ loading tray No. 6..	.564	.25	49,560	2	50.5	47.2	Light-yellow metal; contains minute blowholes.
8″ loading tray No. 7..	.564	.25	52,040	2	35.5	30.4	Uniform light-yellow metal.
8″ loading tray No. 8..	.564	.25	52,080	2	35.5	36.4	Do.
8″ loading tray No. 9..	.564	.25	49,960	2	32.5	33.6	Light lavender colored with spots of yellow metal.
8″ breech plate No. 1..	.564	.25	47,520	2	34	39.2	Uniform light golden yellow color.
8″ breech plate No. 2..	.564	.25	44,080	2	26	27.6	Uniform light-yellow color.
8″ breech plate No. 3..	.564	.25	47,960	2	28.5	33.6	Do.
8″ breech plate No. 4..	.564	.25	50,240	2	34.5	30.4	Do.
8″ breech plate No. 5..	.564	.25	50,040	2	33	33.6	Do.
8″ breech plate No. 6..	.564	.25	50,080	2	32	33.6	Do.
8″ breech plate No. 7..	.564	.25	52,960	2	37	33.6	Do.
8″ breech plate No. 8..	.564	.25	50,240	2	29.5	36.4	Do.
8″ breech plate No. 9..	.564	.25	52,040	2	29.5	30.4	Do.
8″ loading tray No. 1..	.504	.20	50,100	2	25	34	Uniform yellow metal.
8″ loading tray No. 2..	.564	.25	49,440	2	25.5	27.6	Do
8″ loading tray No. 3..	.564	.25	50,880	2	36	36.4	Do
8″ loading tray No. 4..	.564	.25	45,120	2	21	27.6	Lavender colored with spots of yellow metal.
8″ loading tray No. 5..	.564	.25	49,246	2	34.5	33.6	Dark yellow with spots of metal ″.01 diameter nearly black.
8″ loading tray No. 6..	.564	.25	46,080	2	24.5	33.6	Lavender colored with yellow metal interspersed.
8″ breech plate No. 1..	.564	.25	43,920	2	22.5	24.4	Silky irregular surface. Pale lavender and light shade of yellow intermingled.
8″ breech plate No. 2..	.564	.25	48,240	2	26	27.6	Uniform light yellow.
8″ breech plate No. 3..	.564	.25	47,926	2	23	21.6	Uniform golden yellow color.
8″ breech plate No. 4..	.564	.25	51,960	2	26.5	24.4	Uniform light yellow.
8″ breech plate No. 5..	.564	.25	50,440	2	38	39.2	Light yellow. Contains spots of dark-colored metal.
8″ breech plate No. 6..	.564	.25	48,400	2	25.5	24.4	Uniform light yellow.
10″ loading tray No. 1.	.564	.25	51,360	2	24.5	21.6	Light yellow.
10″ loading tray No. 2.	.564	.25	54,280	2	35	30.4	Uniform light yellow.
10″ loading tray No. 3.	.564	.25	55,920	2	34	36.4	Do
10″ loading tray No. 4.	.564	.25	52,960	2	39	36.4	Do

Bronze from Watertown Arsenal Foundry—Continued.

Description.	Diameter.	Sectional area.	Tensile strength per square inch.	Gauged length.	Elongation in gauged length.	Contraction of area.	Fracture.
	Inch.	*Sq. in.*	*Pounds.*	*Inches.*	*Per ct.*	*Per ct.*	
10″ loading tray No. 5.	.564	.25	51,920	2	26	24.4	Light yellow with lines of darker yellow.
10″ loading tray No. 6.	.564	.25	55,040	2	35	36.4	Uniform light yellow.
10″ loading tray No. 7.	.564	.25	57,880	2	29	27.6	Light yellow.
10″ loading tray No. 8.	.564	.25	50,880	2	17	21.6	Light yellow 85 per cent, golden yellow spot near circumference 15 per cent.
10″ loading tray No. 9.	.564	.25	57,160	2	28.5	27.6	Light yellow with golden-yellow spots.
10″ loading tray No. 10.	.564	.25	50,760	2	26.5	27.6	Light yellow.
10″ loading tray No. 11.	.564	.25	49,520	2	15.5	21.6	Light lavender, with golden-yellow metal interspersed.
12″ loading tray No. 1.	.564	.25	57,160	2	26	30.4	Uniform light yellow.
12″ loading tray No. 2.	.564	.25	52,960	2	15	21.6	Light yellow, with dark golden at circumference on one side of stem.
12″ loading tray No. 3.	.564	.25	57,520	2	28.5	30.4	Uniform light yellow.
12″ loading tray No. 4.	.564	.25	56,640	2	29	36.4	Do.
12″ loading tray No. 5.	.564	.25	58,720	2	28.5	30.4	Do.
12″ loading tray No. 6.	.564	.25	55,560	2	25	27.6	Do.
12″ loading tray No. 7.	.564	.25	56,640	2	31	36.4	Do.
12″ loading tray No. 8.	.564	.25	56,120	2	29	30.4	Do.
12″ loading tray No. 9.	.564	.25	57,880	2	31	33.6	Do.
12″ loading tray No. 10.	.564	.25	59,920	2	30.5	27.6	Do.
12″ loading tray No. 11.	.564	.25	60,760	2	35.5	36.4	Do.
12″ B. L. mortar tray..	.564	.25	50,880	2	22	27.6	Light-yellow metal containing minute dark spots, and darker yellow on one side.

Bronze Cast Bar, Representing Material for Statue of Gen. W. S. Hancock, Washington D. C.

No. 8346.



Sectional area, 1″.00×″.99=.99 square inch.
Tensile strength, 31,100 pounds=31,410 pounds per square inch.
Elongation in 4 inches, .77=19.2 per cent.
Elongation of inch sections: ″.16, ″.15, ″.17, ″.29*.
Appearance of fracture, dark-yellow color.
Vesicular surface. A cavity ″.10 wide extends from corner to center of fractured surface. Opened cracks in surface of the bar during the progress of the test.

COPPER CYLINDERS FOR PRESSURE GAUGES.

COPPER CYLINDERS FOR PRESSURE GAUGES.

Mean compression of ten copper cylinders from lot of metal purchased at Frankford Arsenal in April, 1895.
Table for use with crusher gauge $\frac{1}{10}$ square inch area.
Mean dimensions of coppers: Length, ″.4994; diameter, ″.2511.

[Table prepared October 1, 1895.]

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0038	.0045	.0019	.0040	.0036	.0021	.0048	.0036	.0044	.0055	.0038	.0036
9,000	.0141	.0141	.0122	.0132	.0138	.0118	.0155	.0139	.0128	.0160	.0137	.0132
10,000	.0182	.0177	.0160	.0170	.0185	.0158	.0191	.0175	.0160	.0181	.0174	.0168
11,000	.0211	.0213	.0199	.0208	.0216	.0189	.0225	.0203	.0197	.0220	.0208	.0202
12,000	.0249	.0238	.0240	.0258	.0256	.0231	.0267	.0239	.0236	.0258	.0247	.0240
13,000	.0283	.0280	.0278	.0288	.0299	.0268	.0310	.0280	.0270	.0298	.0285	.0277
14,000	.0318	.0321	.0319	.0329	.0340	.0310	.0350	.0326	.0316	.0347	.0328	.0319
15,000	.0364	.0370	.0360	.0378	.0387	.0351	.0389	.0364	.0360	.0385	.0371	.0361
16,000	.0402	.0410	.0403	.0420	.0438	.0392	.0440	.0410	.0395	.0430	.0414	.0403
17,000	.0445	.0454	.0457	.0465	.0468	.0437	.0484	.0456	.0441	.0475	.0458	.0447
18,000	.0490	.0504	.0485	.0511	.0515	.0493	.0529	.0501	.0490	.0521	.0504	.0493
19,000	.0533	.0545	.0541	.0564	.0567	.0525	.0578	.0545	.0539	.0577	.0551	.0540
20,000	.0583	.0602	.0583	.0602	.0611	.0579	.0625	.0576	.0583	.0631	.0597	.0586
21,000	.0628	.0648	.0630	.0655	.0659	.0628	.0682	.0645	.0626	.0680	.0648	.0637
22,000	.0664	.0689	.0687	.0700	.0705	.0664	.0720	.0689	.0674	.0720	.0691	.0680
23,000	.0738	.0739	.0730	.0765	.0755	.0721	.0776	.0731	.0723	.0765	.0744	.0733
24,000	.0785	.0791	.0773	.0801	.0808	.0766	.0820	.0779	.0770	.0817	.0791	.0779
25,000	.0827	.0844	.0835	.0850	.0867	.0820	.0881	.0836	.0820	.0865	.0844	.0832
26,000	.0884	.0897	.0879	.0902	.0918	.0866	.0930	.0884	.0872	.0921	.0895	.0883
27,000	.0931	.0950	.0920	.0955	.0972	.0919	.0978	.0936	.0922	.0962	.0944	.0932
28,000	.0980	.1009	.0983	.1005	.1021	.0970	.1034	.0984	.0970	.1027	.0998	.0986
29,000	.1046	.1050	.1044	.1064	.1074	.1018	.1095	.1039	.1018	.1086	.1053	.1041
30,000	.1089	.1106	.1074	.1118	.1120	.1069	.1150	.1086	.1081	.1134	.1103	.1090
31,000	.1130	.1159	.1119	.1175	.1171	.1124	.1190	.1143	.1126	.1180	.1152	.1139
32,000	.1194	.1210	.1178	.1220	.1232	.1178	.1246	.1195	.1181	.1240	.1207	.1194
33,000	.1239	.1260	.1230	.1278	.1284	.1227	.1297	.1253	.1225	.1290	.1258	.1245
34,000	.1295	.1314	.1279	.1324	.1343	.1280	.1350	.1300	.1279	.1337	.1310	.1297
35,000	.1346	.1370	.1330	.1389	.1394	.1324	.1404	.1354	.1331	.1389	.1363	.1349
36,000	.1394	.1421	.1390	.1433	.1455	.1382	.1453	.1405	.1385	.1447	.1416	.1402
37,000	.1451	.1474	.1426	.1487	.1514	.1440	.1504	.1470	.1440	.1506	.1471	.1457
38,000	.1500	.1532	.1474	.1540	.1558	.1487	.1560	.1510	.1486	.1556	.1520	.1506
39,000	.1553	.1589	.1534	.1589	.1609	.1540	.1615	.1565	.1536	.1615	.1574	.1560
40,000	.1605	.1620	.1586	.1644	.1673	.1574	.1670	.1612	.1585	.1660	.1623	.1609
41,000	.1654	.1681	.1623	.1693	.1717	.1635	.1714	.1670	.1634	.1713	.1673	.1659
42,000	.1698	.1733	.1678	.1751	.1769	.1684	.1770	.1722	.1685	.1765	.1725	.1711
43,000	.1748	.1786	.1722	.1799	.1824	.1738	.1818	.1761	.1740	.1816	.1775	.1761
44,000	.1805	.1832	.1769	.1852	.1867	.1785	.1865	.1815	.1780	.1870	.1824	.1810
45,000	.1860	.1880	.1825	.1889	.1925	.1831	.1910	.1860	.1834	.1911	.1872	.1858
46,000	.1915	.1925	.1860	.1936	.1970	.1878	.1959	.1913	.1876	.1960	.1919	.1905
47,000	.1967	.1970	.1911	.1987	.2015	.1929	.2012	.1965	.1923	.2009	.1969	.1955
48,000	.1993	.2040	.1953	.2042	.2060	.1970	.2060	.2015	.1970	.2055	.2016	.2002
49,000	.2045	.2074	.2000	.2085	.2108	.2019	.2101	.2055	.2018	.2092	.2060	.2046
50,000	.2092	.2120	.2054	.2118	.2156	.2059	.2154	.2100	.2056	.2135	.2104	.2090
51,000	.2134	.2160	.2089	.2166	.2195	.2102	.2188	.2140	.2095	.2183	.2145	.2131
52,000	.2170	.2200	.2130	.2205	.2238	.2145	.2230	.2183	.2140	.2222	.2186	.2172
53,000	.2220	.2231	.2160	.2249	.2274	.2189	.2267	.2228	.2181	.2260	.2226	.2212
54,000	.2252	.2276	.2191	.2284	.2319	.2220	.2310	.2256	.2224	.2298	.2263	.2249
55,000	.2290	.2316	.2238	.2322	.2352	.2264	.2349	.2294	.2256	.2335	.2302	.2288
56,000	.2330	.2345	.2276	.2364	.2385	.2300	.2380	.2334	.2291	.2369	.2337	.2323
57,000	.2359	.2385	.2314	.2402	.2425	.2337	.2420	.2369	.2331	.2407	.2375	.2362
58,000	.2400	.2413	.2349	.2432	.2461	.2365	.2452	.2408	.2365	.2446	.2409	.2396
59,000	.2435	.2446	.2385	.2461	.2494	.2401	.2486	.2438	.2400	.2480	.2443	.2430
60,000	.2462	.2481	.2416	.2493	.2525	.2441	.2521	.2474	.2435	.2511	.2476	.2463
61,000	.2490	.2511	.2447	.2522	.2553	.2468	.2550	.2504	.2465	.2541	.2505	.2492
62,000	.2522	.2543	.2479	.2558	.2588	.2497	.2581	.2534	.2497	.2575	.2537	.2524
63,000	.2552	.2574	.2509	.2582	.2618	.2531	.2606	.2564	.2526	.2605	.2567	.2554
64,000	.2583	.2618	.2540	.2616	.2650	.2556	.2640	.2593	.2552	.2635	.2598	.2585
65,000	.2616	.2632	.2569	.2645	.2671	.2589	.2663	.2626	.2581	.2660	.2625	.2612

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge $\frac{1}{10}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
66,000	.2636	.2657	.2595	.2670	.2702	.2617	.2696	.2648	.2612	.2688	.2652	.2639
67,000	.2665	.2683	.2629	.2700	.2727	.2640	.2718	.2670	.2636	.2715	.2678	.2665
68,000	.2690	.2710	.2646	.2730	.2748	.2666	.2746	.2702	.2660	.2736	.2703	.2691
69,000	.2715	.2734	.2674	.2748	.2774	.2693	.2770	.2726	.2690	.2765	.2729	.2717
70,000	.2740	.2758	.2705	.2770	.2800	.2715	.2799	.2750	.2714	.2788	.2754	.2742
71,000	.2767	.2785	.2723	.2797	.2821	.2740	.2815	.2775	.2739	.2815	.2778	.2766
72,000	.2787	.2808	.2748	.2820	.2845	.2766	.2841	.2798	.2762	.2840	.2801	.2789
73,000	.2811	.2832	.2772	.2844	.2870	.2790	.2864	.2820	.2781	.2860	.2824	.2812
74,000	.2835	.2855	.2793	.2867	.2891	.2812	.2890	.2840	.2806	.2879	.2847	.2835
75,000	.2857	.2878	.2819	.2889	.2914	.2834	.2910	.2868	.2836	.2906	.2871	.2859
76,000	.2879	.2900	.2840	.2911	.2934	.2857	.2931	.2890	.2851	.2927	.2892	.2880
77,000	.2897	.2920	.2857	.2936	.2955	.2875	.2951	.2909	.2874	.2946	.2912	.2900
78,000	.2920	.2938	.2882	.2954	.2975	.2900	.2970	.2930	.2895	.2966	.2933	.2921
79,000	.2941	.2962	.2904	.2971	.2994	.2909	.2993	.2955	.2913	.2986	.2953	.2941
80,000	.2962	.2979	.2927	.2995	.3015	.2936	.3010	.2970	.2940	.3006	.2974	.2962
81,000	.2975	.2998	.2940	.3010	.3030	.2957	.3029	.2990	.2956	.3025	.2991	.2979
82,000	.2995	.3019	.2962	.3032	.3052	.2978	.3049	.3007	.2977	.3046	.3012	.3000
83,000	.3016	.3037	.2980	.3048	.3071	.2998	.3066	.3025	.2994	.3065	.3030	.3018
84,000	.3033	.3055	.3000	.3066	.3090	.3011	.3085	.3046	.3014	.3081	.3048	.3038
85,000	.3050	.3074	.3015	.3084	.3108	.3029	.3106	.3061	.3034	.3100	.3066	.3056
86,000	.3070	.3090	.3033	.3100	.3125	.3048	.3121	.3080	.3049	.3116	.3083	.3073
87,000	.3085	.3106	.3050	.3116	.3141	.3065	.3136	.3100	.3063	.3133	.3099	.3089
88,000	.3100	.3125	.3069	.3135	.3160	.3080	.3154	.3114	.3081	.3148	.3117	.3107
89,000	.3118	.3141	.3087	.3152	.3174	.3096	.3169	.3129	.3100	.3175	.3134	.3124
90,000	.3134	.3160	.3104	.3169	.3192	.3115	.3185	.3150	.3119	.3184	.3151	.3141
91,000	.3146	.3171	.3140	.3188	.3208	.3130	.3201	.3163	.3134	.3196	.3168	.3158
92,000	.3164	.3190	.3155	.3204	.3223	.3148	.3219	.3176	.3153	.3210	.3184	.3175
93,000	.3180	.3204	.3160	.3215	.3237	.3165	.3230	.3194	.3163	.3225	.3197	.3188
94,000	.3191	.3220	.3170	.3231	.3251	.3176	.3242	.3207	.3176	.3240	.3210	.3201
95,000	.3209	.3235	.3181	.3244	.3265	.3190	.3256	.3225	.3181	.3257	.3224	.3215
96,000	.3225	.3246	.3194	.3259	.3283	.3208	.3271	.3236	.3207	.3266	.3239	.3230
97,000	.3235	.3262	.3210	.3272	.3297	.3220	.3286	.3250	.3221	.3282	.3253	.3244
98,000	.3248	.3274	.3225	.3288	.3306	.3235	.3299	.3264	.3234	.3298	.3267	.3258
99,000	.3262	.3290	.3240	.3300	.3321	.3246	.3310	.3278	.3249	.3307	.3280	.3271
100,000	.3275	.3300	.3251	.3316	.3333	.3260	.3325	.3291	.3264	.3325	.3294	.3285

Mean compression of ten copper cylinders from lot of metal purchased at Frankford Arsenal in April, 1895.

Table for use with crusher gauge $\frac{1}{30}$ square inch area.

Mean dimensions of coppers: Length, ″.4995; diameter, ″.2054.

[Table prepared July 31, 1895.]

Load per square inch on crusher gauge $\frac{1}{30}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0002	.0003	.0003	.0002	.0004	.0003	.0004	.0002	.0004	.0003	.0003	.0003
9,000	.0006	.0006	.0007	.0003	.0006	.0006	.0009	.0004	.0008	.0006	.0006	.0005
10,000	.0007	.0009	.0009	.0005	.0008	.0007	.0013	.0007	.0011	.0009	.0008	.0007
11,000	.0008	.0013	.0012	.0007	.0009	.0009	.0018	.0008	.0016	.0010	.0011	.0010
12,000	.0010	.0021	.0015	.0020	.0012	.0014	.0025	.0010	.0023	.0014	.0016	.0015
13,000	.0015	.0039	.0023	.0035	.0020	.0028	.0040	.0022	.0034	.0030	.0029	.0028
14,000	.0031	.0054	.0036	.0059	.0035	.0044	.0055	.0038	.0049	.0044	.0044	.0042
15,000	.0045	.0072	.0051	.0070	.0052	.0064	.0071	.0056	.0064	.0063	.0061	.0059
16,000	.0060	.0090	.0074	.0086	.0068	.0081	.0090	.0074	.0086	.0080	.0079	.0076
17,000	.0076	.0104	.0091	.0107	.0085	.0097	.0109	.0093	.0102	.0097	.0096	.0092
18,000	.0095	.0128	.0110	.0122	.0104	.0119	.0130	.0114	.0120	.0115	.0116	.0112
19,000	.0112	.0143	.0128	.0145	.0124	.0135	.0148	.0125	.0139	.0132	.0133	.0129
20,000	.0133	.0164	.0148	.0160	.0146	.0152	.0165	.0150	.0163	.0155	.0154	.0149
21,000	.0153	.0182	.0166	.0183	.0160	.0178	.0184	.0168	.0176	.0170	.0172	.0167
22,000	.0171	.0200	.0183	.0202	.0179	.0193	.0204	.0182	.0200	.0190	.0190	.0185
23,000	.0189	.0220	.0202	.0229	.0200	.0212	.0225	.0206	.0215	.0216	.0211	.0205
24,000	.0209	.0244	.0225	.0249	.0216	.0238	.0244	.0228	.0237	.0235	.0232	.0226
25,000	.0230	.0260	.0239	.0264	.0243	.0256	.0265	.0246	.0258	.0248	.0251	.0244
26,000	.0250	.0281	.0263	.0283	.0256	.0274	.0289	.0265	.0273	.0275	.0271	.0264
27,000	.0269	.0306	.0284	.0314	.0281	.0300	.0307	.0284	.0300	.0297	.0294	.0286
28,000	.0288	.0325	.0308	.0328	.0298	.0318	.0333	.0306	.0321	.0310	.0313	.0305
29,000	.0313	.0347	.0329	.0349	.0320	.0342	.0354	.0328	.0335	.0345	.0336	.0327
30,000	.0324	.0370	.0355	.0377	.0345	.0366	.0380	.0349	.0355	.0367	.0359	.0350
31,000	.0355	.0390	.0370	.0394	.0374	.0380	.0394	.0370	.0380	.0381	.0379	.0369
32,000	.0384	.0424	.0389	.0416	.0389	.0402	.0416	.0394	.0403	.0402	.0402	.0392
33,000	.0402	.0439	.0420	.0440	.0415	.0435	.0439	.0419	.0421	.0424	.0425	.0415
34,000	.0423	.0464	.0444	.0465	.0429	.0447	.0461	.0444	.0460	.0446	.0448	.0437
35,000	.0450	.0480	.0461	.0484	.0453	.0479	.0489	.0469	.0472	.0466	.0470	.0459
36,000	.0472	.0510	.0485	.0506	.0476	.0494	.0510	.0485	.0495	.0499	.0493	.0482
37,000	.0487	.0528	.0507	.0531	.0497	.0519	.0532	.0502	.0516	.0517	.0514	.0503
38,000	.0513	.0551	.0525	.0550	.0525	.0546	.0555	.0532	.0547	.0541	.0538	.0527
39,000	.0537	.0574	.0556	.0569	.0539	.0562	.0579	.0555	.0574	.0565	.0561	.0550
40,000	.0556	.0596	.0566	.0597	.0564	.0583	.0599	.0578	.0588	.0585	.0581	.0570
41,000	.0586	.0626	.0598	.0619	.0589	.0613	.0624	.0599	.0610	.0611	.0607	.0596
42,000	.0605	.0646	.0621	.0654	.0615	.0630	.0651	.0630	.0641	.0637	.0633	.0622
43,000	.0628	.0670	.0650	.0670	.0638	.0655	.0671	.0652	.0657	.0655	.0655	.0644
44,000	.0646	.0697	.0667	.0690	.0659	.0676	.0693	.0667	.0682	.0674	.0675	.0664
45,000	.0678	.0714	.0689	.0725	.0681	.0702	.0719	.0688	.0710	.0710	.0702	.0691
46,000	.0698	.0740	.0720	.0739	.0730	.0732	.0743	.0720	.0729	.0729	.0728	.0717
47,000	.0725	.0762	.0735	.0770	.0740	.0754	.0766	.0749	.0759	.0753	.0751	.0739
48,000	.0751	.0791	.0759	.0790	.0753	.0775	.0791	.0763	.0778	.0781	.0773	.0761
49,000	.0785	.0816	.0795	.0817	.0781	.0798	.0816	.0783	.0800	.0804	.0799	.0787
50,000	.0799	.0838	.0816	.0835	.0800	.0818	.0839	.0815	.0831	.0826	.0822	.0810
51,000	.0823	.0859	.0836	.0862	.0828	.0848	.0868	.0841	.0856	.0854	.0847	.0835
52,000	.0837	.0886	.0864	.0885	.0850	.0869	.0885	.0857	.0880	.0875	.0869	.0857
53,000	.0861	.0920	.0890	.0913	.0871	.0890	.0910	.0880	.0900	.0893	.0893	.0881
54,000	.0896	.0941	.0910	.0936	.0902	.0918	.0938	.0918	.0930	.0919	.0921	.0909
55,000	.0920	.0971	.0938	.0961	.0920	.0945	.0955	.0932	.0946	.0936	.0942	.0930
56,000	.0940	.0988	.0969	.0982	.0950	.0968	.0993	.0951	.0970	.0968	.0968	.0956
57,000	.0963	.1015	.0983	.1019	.0973	.0995	.1006	.0990	.0999	.0992	.0993	.0981
58,000	.0981	.1034	.1004	.1037	.0995	.1019	.1033	.1005	.1028	.1024	.1016	.1004
59,000	.1018	.1070	.1036	.1063	.1015	.1041	.1068	.1030	.1055	.1050	.1045	.1033
60,000	.1040	.1090	.1069	.1096	.1041	.1071	.1088	.1060	.1074	.1073	.1070	.1057
61,000	.1059	.1108	.1080	.1107	.1070	.1088	.1108	.1083	.1100	.1094	.1090	.1077
62,000	.1085	.1130	.1105	.1130	.1095	.1120	.1136	.1107	.1125	.1125	.1116	.1103
63,000	.1109	.1160	.1130	.1168	.1121	.1145	.1159	.1141	.1145	.1142	.1142	.1129
64,000	.1130	.1189	.1159	.1195	.1147	.1164	.1180	.1169	.1170	.1172	.1167	.1154
65,000	.1159	.1211	.1181	.1213	.1163	.1191	.1210	.1188	.1194	.1198	.1191	.1178
66,000	.1181	.1240	.1206	.1238	.1186	.1215	.1230	.1210	.1224	.1220	.1215	.1202
67,000	.1203	.1272	.1230	.1260	.1220	.1242	.1253	.1235	.1250	.1240	.1240	.1227
68,000	.1225	.1289	.1257	.1281	.1240	.1265	.1280	.1260	.1266	.1265	.1263	.1250
69,000	.1261	.1311	.1291	.1311	.1261	.1292	.1305	.1290	.1295	.1286	.1290	.1276
70,000	.1283	.1340	.1308	.1336	.1284	.1320	.1328	.1311	.1321	.1315	.1315	.1301
71,000	.1302	.1358	.1330	.1364	.1306	.1334	.1355	.1336	.1343	.1341	.1337	.1323

Copper cylinders for pressure gauges—Continued.

Load per square inch on crusher gauge $\frac{1}{30}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
72, 000	.1329	.1385	.1355	.1384	.1336	.1365	.1379	.1355	.1365	.1374	.1363	.1349
73, 000	.1345	.1415	.1381	.1405	.1356	.1388	.1400	.1395	.1395	.1394	.1387	.1373
74, 000	.1365	.1440	.1403	.1433	.1385	.1406	.1427	.1415	.1411	.1410	.1409	.1395
75, 000	.1395	.1460	.1428	.1457	.1410	.1441	.1454	.1429	.1450	.1445	.1437	.1423
76, 000	.1420	.1481	.1456	.1480	.1430	.1454	.1475	.1452	.1468	.1465	.1458	.1444
77, 000	.1440	.1508	.1478	.1503	.1448	.1480	.1495	.1491	.1486	.1490	.1482	.1468
78, 000	.1465	.1532	.1500	.1530	.1483	.1514	.1525	.1510	.1510	.1517	.1509	.1495
79, 000	.1495	.1560	.1529	.1546	.1499	.1532	.1546	.1532	.1537	.1540	.1532	.1518
80, 000	.1511	.1581	.1545	.1570	.1515	.1552	.1568	.1548	.1565	.1557	.1551	.1537
81, 000	.1538	.1606	.1565	.1605	.1541	.1569	.1597	.1570	.1584	.1575	.1575	.1561
82, 000	.1554	.1623	.1586	.1629	.1564	.1598	.1626	.1590	.1609	.1605	.1598	.1584
83, 000	.1573	.1649	.1612	.1643	.1587	.1620	.1638	.1608	.1625	.1639	.1619	.1605
84, 000	.1602	.1671	.1635	.1665	.1606	.1647	.1660	.1631	.1651	.1654	.1642	.1628
85, 000	.1620	.1700	.1653	.1693	.1638	.1664	.1685	.1660	.1669	.1663	.1664	.1650
86, 000	.1643	.1775	.1685	.1707	.1650	.1695	.1702	.1679	.1696	.1685	.1692	.1678
87, 000	.1665	.1743	.1706	.1730	.1669	.1713	.1730	.1705	.1716	.1720	.1710	.1696
88, 000	.1687	.1768	.1730	.1758	.1690	.1734	.1749	.1727	.1738	.1733	.1731	.1717
89, 000	.1711	.1784	.1748	.1779	.1716	.1755	.1766	.1744	.1765	.1752	.1752	.1738
90, 000	.1728	.1806	.1772	.1805	.1735	.1775	.1795	.1769	.1795	.1789	.1777	.1763
91, 000	.1750	.1828	.1793	.1819	.1755	.1805	.1815	.1784	.1810	.1806	.1796	.1782
92, 000	.1764	.1855	.1813	.1840	.1771	.1820	.1832	.1804	.1824	.1819	.1814	.1800
93, 000	.1785	.1875	.1835	.1861	.1791	.1848	.1868	.1830	.1846	.1838	.1838	.1824
94, 000	.1810	.1891	.1860	.1883	.1814	.1862	.1885	.1850	.1862	.1864	.1858	.1844
95, 000	.1839	.1910	.1880	.1898	.1840	.1880	.1903	.1869	.1884	.1875	.1878	.1864
96, 000	.1852	.1929	.1894	.1919	.1857	.1904	.1920	.1891	.1904	.1898	.1897	.1883
97, 000	.1863	.1947	.1920	.1938	.1873	.1921	.1939	.1911	.1932	.1920	.1916	.1902
98, 000	.1880	.1968	.1936	.1965	.1891	.1942	.1953	.1932	.1949	.1935	.1935	.1921
99, 000	.1898	.1985	.1958	.1976	.1908	.1955	.1969	.1953	.1967	.1959	.1953	.1939
100, 000	.1920	.2008	.1974	.1993	.1931	.1980	.1990	.1972	.1988	.1983	.1974	.1960

RIVETED JOINTS.

RIVETED JOINTS.

These joints were prepared and contributed for testing by Edward Kendall & Sons, Cambridgeport, Mass.

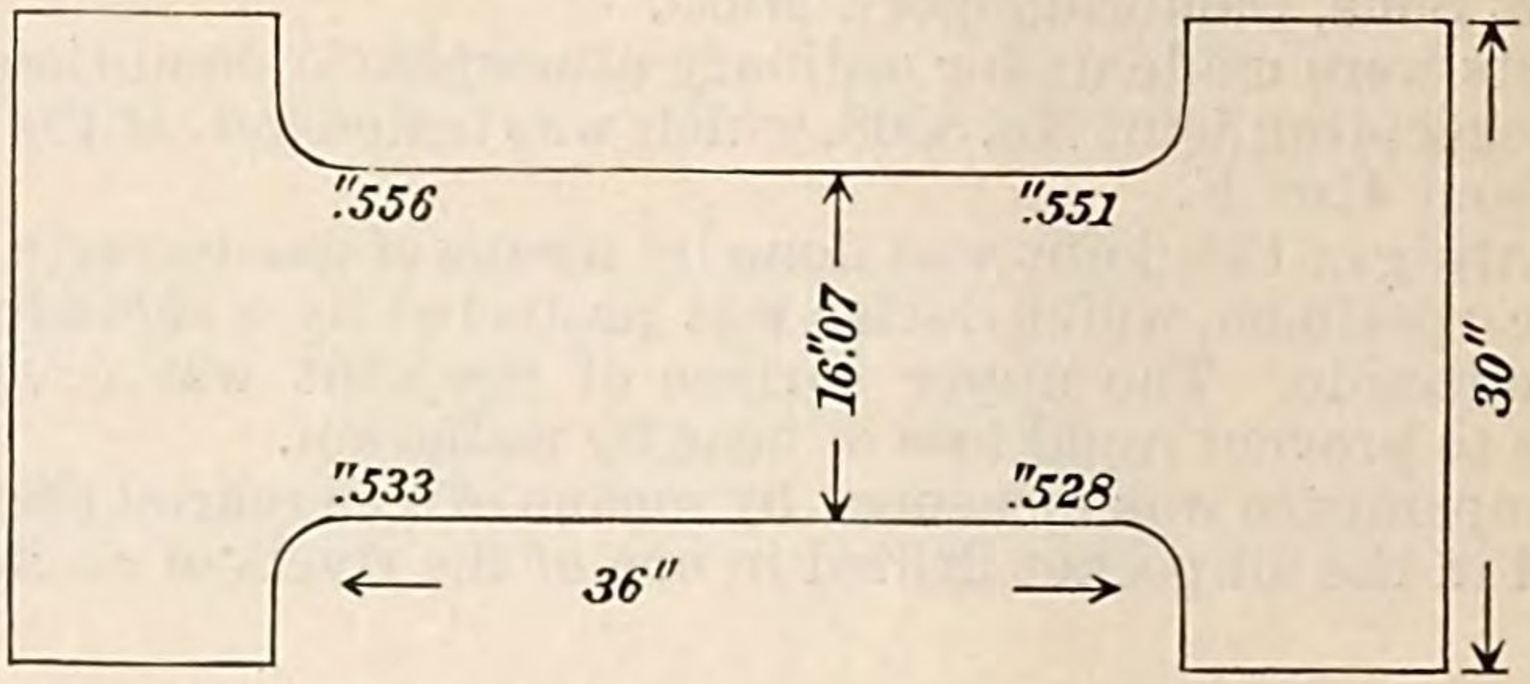
The tests were made under ordinary atmospheric conditions of temperature excepting joint No. 8508, which was tested hot, at the temperature of about 410° F.

The heating of this joint was done by means of gas-burners arranged below the specimen, which latter was protected by a sheet-iron muffle on the underside. The upper surface of the joint was covered with dry ashes to prevent rapid loss of heat by radiation.

The temperature was measured by means of a mercurial thermometer immersed in the oil pocket drilled in one of the rivets of an inside row.

Steel Plate Representing Metal Used in Riveted Joints Nos. 9374, 9375, 9376, 9377, 9436, and 9437.

No. 9438.



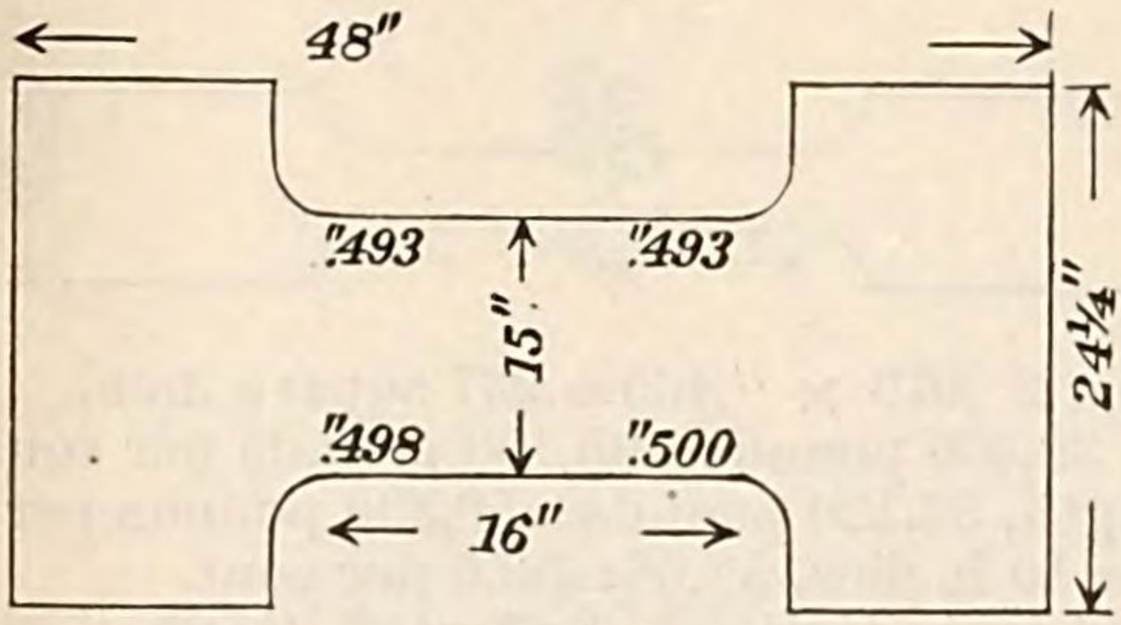
Brand on plate, "Coatsville, Pa., Fire box 55,000."
Sectional area, 8.75 square inches.
Gauged length, 30".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
8,750	1,000	0.	0.	Initial load.
43,750	5,000	.0059	.0010	
87,500	10,000	.0114	.0010	
131,250	15,000	.0169	.0010	
175,000	20,000	.0223	.0010	
218,750	25,000	.0278	.0016	
227,500	26,000	.0289	----------	
236,250	27,000	.0301	----------	
245,000	28,000	.0313	----------	
253,750	29,000	.0327	----------	
262,500	30,000	.0339	.0030	Elastic limit.
271,250	31,000	.0354	----------	
280,000	32,000	.0373	----------	
288,750	33,000	.0406	----------	
297,500	34,000	.0474	----------	Scale starts off plate.
306,250	35,000	.11	----------	
315,000	36,000	.53	----------	
323,750	37,000	.57	----------	
332,500	38,000	.61	----------	
341,250	39,000	.66	----------	
350,000	40,000	.71	----------	
358,750	41,000	.77	----------	
367,500	42,000	.83	----------	
376,250	43,000	.89	----------	
385,000	44,000	.96	----------	
393,750	45,000	1.04	----------	
402,500	46,000	1.11	----------	
411,250	47,000	1.20	----------	
420,000	48,400	1.30	----------	
428,750	49,000	1.40	----------	
437,500	50,000	1.51	----------	
446,250	51,000	1.64	----------	
455,000	52,000	1.79	----------	
463,750	53,000	1.95	----------	
472,500	54,000	2.14	----------	
481,250	55,000	2.36	----------	
490,000	56,000	2.60	----------	
498,750	57,000	2.92	----------	
507,500	58,000	3.99	----------	
522,200	59,680	----------	----------	Tensile strength.

Elongation in 30 inches, 4".63 = 15.4 per cent.
Elongation of 5-inch sections: ".68, ".78, ".81, ".78, ".79, ".79.
Minimum width of plate after the test, 15".05.
Plate tore apart, the fracture beginning at the neck and gradually extending across its width. Appearance silky, slightly lamellar.

STEEL PLATE REPRESENTING METAL USED IN RIVETED JOINTS NOS. 8506 TO 8510, INCLUSIVE.

No. 8505.



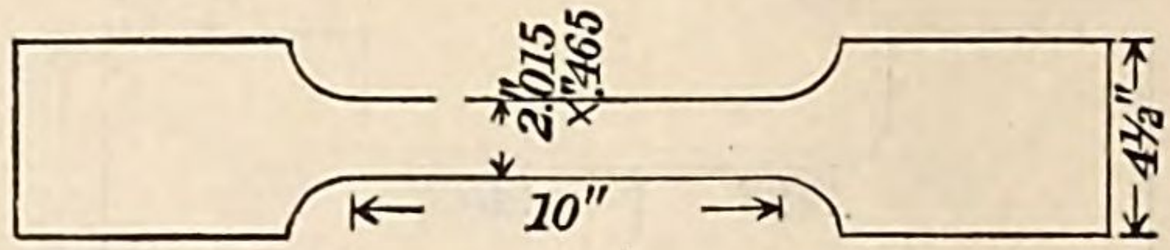
Sectional area, 7.43 square inches.
Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
7,430	1,000	0.	0.	Initial load.
37,150	5,000	.0021	.....	
74,300	10,000	.0044	.0003	
111,450	15,000	.0066	.....	
148,600	20,000	.0091	.....	
185,750	25,000	.0116	.....	
193,180	26,000	.0119	.....	
200,610	27,000	.0127	.....	
208,040	28,000	.0132	.....	
215,470	29,000	.0136	.....	
222,900	30,000	.0142	.0000	
230,330	31,000	.0146	.....	
237,760	32,000	.0150	.....	
245,190	33,000	.0155	.....	
252,620	34,000	.0160	.....	Elastic limit.
260,050	35,000	.0185	.0016	
267,480	36,000	.13	.....	
274,910	37,000	.26	.....	
282,340	38,000	.28	.....	
289,770	39,000	.30	.....	
297,200	40,000	.32	.....	
304,630	41,000	.35	.....	
312,060	42,000	.36	.....	
319,490	43,000	.38	.....	
326,920	44,000	.41	.....	
334,350	45,000	.45	.....	
341,780	46,000	.49	.....	
349,210	47,000	.53	.....	
356,640	48,000	.57	.....	
364,070	49,000	.61	.....	
371,500	50,000	.66	.....	
378,930	51,000	.71	.....	
386,360	52,000	.77	.....	
393,790	53,000	.82	.....	
401,220	54,000	.91	.....	
408,650	55,000	1.01	.....	
416,080	56.000	1.11	.....	
423,510	57,000	1.26	.....	
430,940	58,000	1.41	.....	
438,370	59,000	1.62	.....	
445,800	60,000	1.89	.....	
449,900	60,550	2.25	.....	Tensile strength.

Elongation in 15 inches, 2″.43=16.2 per cent.
Elongation of inch sections: ″.19, ″.18, ″.16, ″.16, ″.18, ″.17, ″.17, ″.17, ″.19, ″.18, ″.16, ″.16, ″.15, ″.11, ″.10.
Minimum width after fracture, 13″.96.
Fractured at the neck. Appearance silky, lamellar.

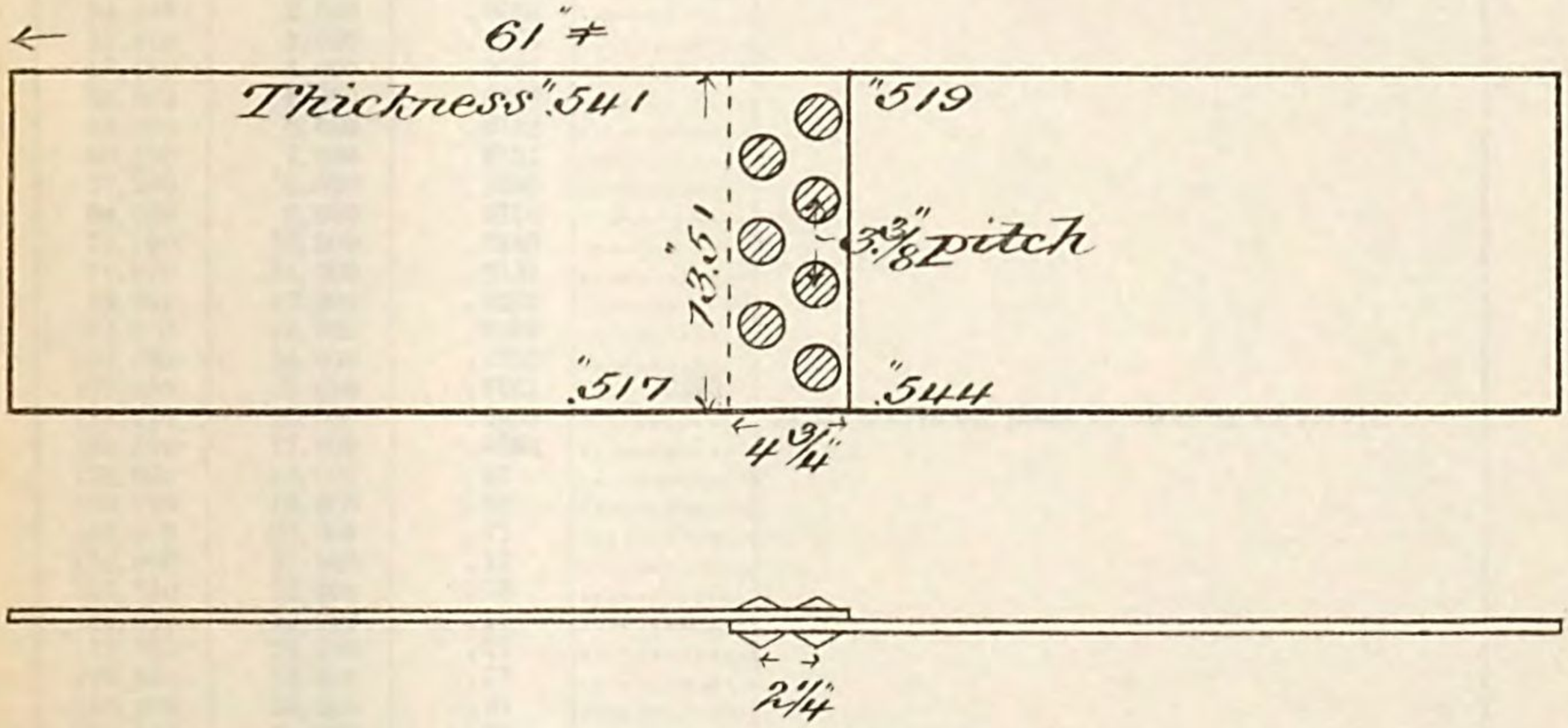
Steel Plate Representing Metal Used in Riveted Joints Nos. 8515 and 8516.

No. 8517.



Sectional area, 2″.015 × ″.465=.937 square inch.
Elastic limit, 32,950 pounds=35,160 pounds per square inch.
Tensile strength, 56,120 pounds=59,890 pounds per square inch.
Elongation in 10 inches, 3″.06=30.6 per cent.
Elongation of inch sections: ″.23, ″.27, ″.72*, ″.39, ″.27, ″.25, ″.24, ″.24, ″.24, ″.21.
Area at fracture, 1″.47 × ″.30=.441 square inch.
Contraction of area, 52.9 per cent.
Appearance of fracture, silky.

No. 9374



7/8" steel rivets

15/16" drilled holes

No. 9374.

Gross sectional area of plate.....square inches.. 7.17
Net sectional area of plate.....do.... 5.18
Bearing surface of rivets.....do.... 3.48
Shearing area of rivets.....do.... 4.83

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,170	1,000	0.	0.	Initial load.
14,340	2,000	.0009	.....	
21,510	3,000	.0021	.....	
28,680	4,000	.0032	.....	
35,850	5,000	.0048	.0008	
43,020	6,000	.0065	.....	
50,190	7,000	.0083	.....	
57,360	8,000	.0104	.....	
64,530	9,000	.0128	.....	Scale starts off two rivet heads.
71,700	10,000	.0161	.0055	
7,170	1,000	.....	.0055	
14,340	2,000	.0063	.....	
21,510	3,000	.0074	.....	
28,680	4,000	.0085	.....	
35,850	5,000	.0096	.....	
43,020	6,000	.0108	.....	
50,190	7,000	.0121	.....	
57,360	8,000	.0136	.....	
64,530	9,000	.0150	.....	
71,700	10,000	.0165	.....	
78,870	11,000	.0191	.....	
86,040	12,000	.0223	.....	
93,210	13,000	.0260	.....	
100,380	14,000	.0301	.....	
107,550	15,000	.0361	.0175	
114,720	16,000	.0459	.....	Scale starts off plate in vicinity of rivets.
121,890	17,000	.0564	.....	
129,060	18,000	.07	.....	
136,230	19,000	.09	.....	
143,400	20,000	.11	.....	
150,570	21,000	.12	.....	
157,740	22,000	.13	.....	
164,910	23,000	.15	.....	
172,080	24,000	.17	.....	
179,250	25,000	.21	.....	
186,420	26,000	.24	.....	
193,590	27,000	.29	.....	
200,760	28,000	.36	.....	
201,700	28,130	.....	.....	Tensile strength.

Sheared the rivets.

Elongation of rivet holes { Outside row ..... ″.05
Inside row ..... .02

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 28.130
Tension on net section of plate.....do.... 38.940
Compression on bearing surface of rivets.....do.... 57.960
Shearing on rivets.....do.... 41.760

Efficiency of joint, 47.1 per cent.

No. 9377.

Gross sectional area of plate	square inches	14.44
Net sectional area of plate	do	12.44
Bearing surface of rivets	do	6.02
Shearing area of rivets	do	13.80

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,440	1,000	0.	0.	Initial load.
28,880	2,000	.0007	.....	
43,320	3,000	.0016	.....	
57,760	4,000	.0027	.....	
72,200	5,000	.0041	.0014	
86,640	6,000	.0059	.....	
101,080	7,000	.0078	.....	
115,520	8,000	.0096	.....	Scale starts off rivet heads, outside row.
129,960	9,000	.0116	.....	
144,400	10,000	.0136	.0066	
158,840	11,000	.0160	.....	
173,280	12,000	.0186	.....	
187,720	13,000	.0205	.....	
202,160	14,000	.0227	.....	
216,600	15,000	.0250	.0122	
231,040	16,000	.0280	.....	
245,480	17,000	.0306	.....	
259,920	18,000	.0339	.....	
274,360	19,000	.0366	.....	
288,800	20,000	.0400	.0211	
303,240	21,000	.0455	.....	
317,680	22,000	.0534	.....	
332,120	23,000	.06	.....	
346,560	24,000	.07	.....	
361,000	25,000	.09	.....	
375,440	26,000	.11	.....	
389,880	27,000	.13	.....	
404,320	28,000	.16	.....	
418,760	29,000	.18	.....	Scale starts off plate.
433,200	30,000	.22	.....	
447,640	31,000	.27	.....	
462,080	32,000	.33	.....	
476,520	33,000	.45	.....	
490,800	33,990	.....	.....	Tensile strength.

Sheared outside row of rivets in plate A, and tore out plate in front of rivet holes at inside row.

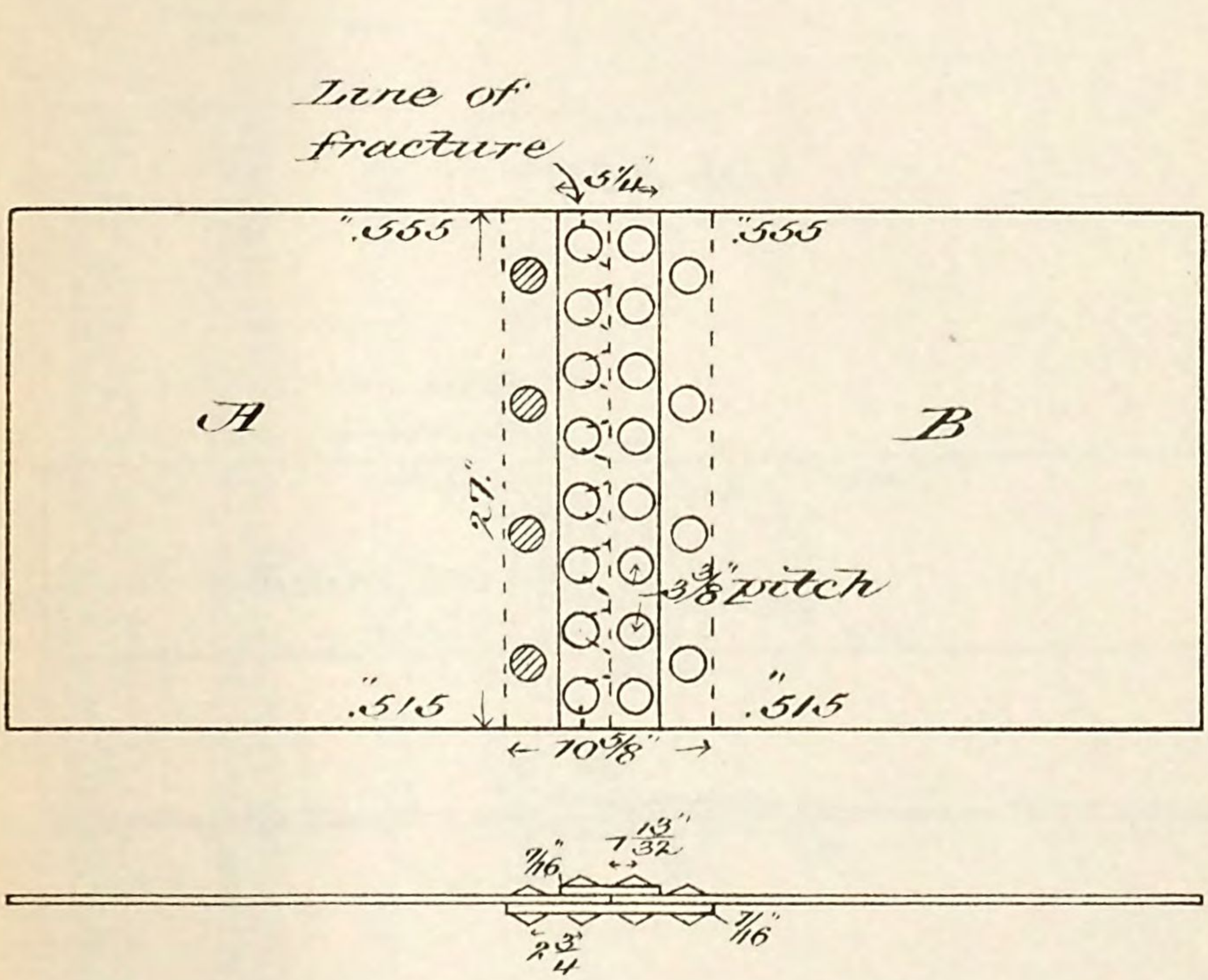
Outside row of rivet holes elongated ″.09.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	33,900
Tension on net section of plate	do	39,450
Compression on bearing surface of rivets	do	81,530
Shearing on rivets	do	35,560

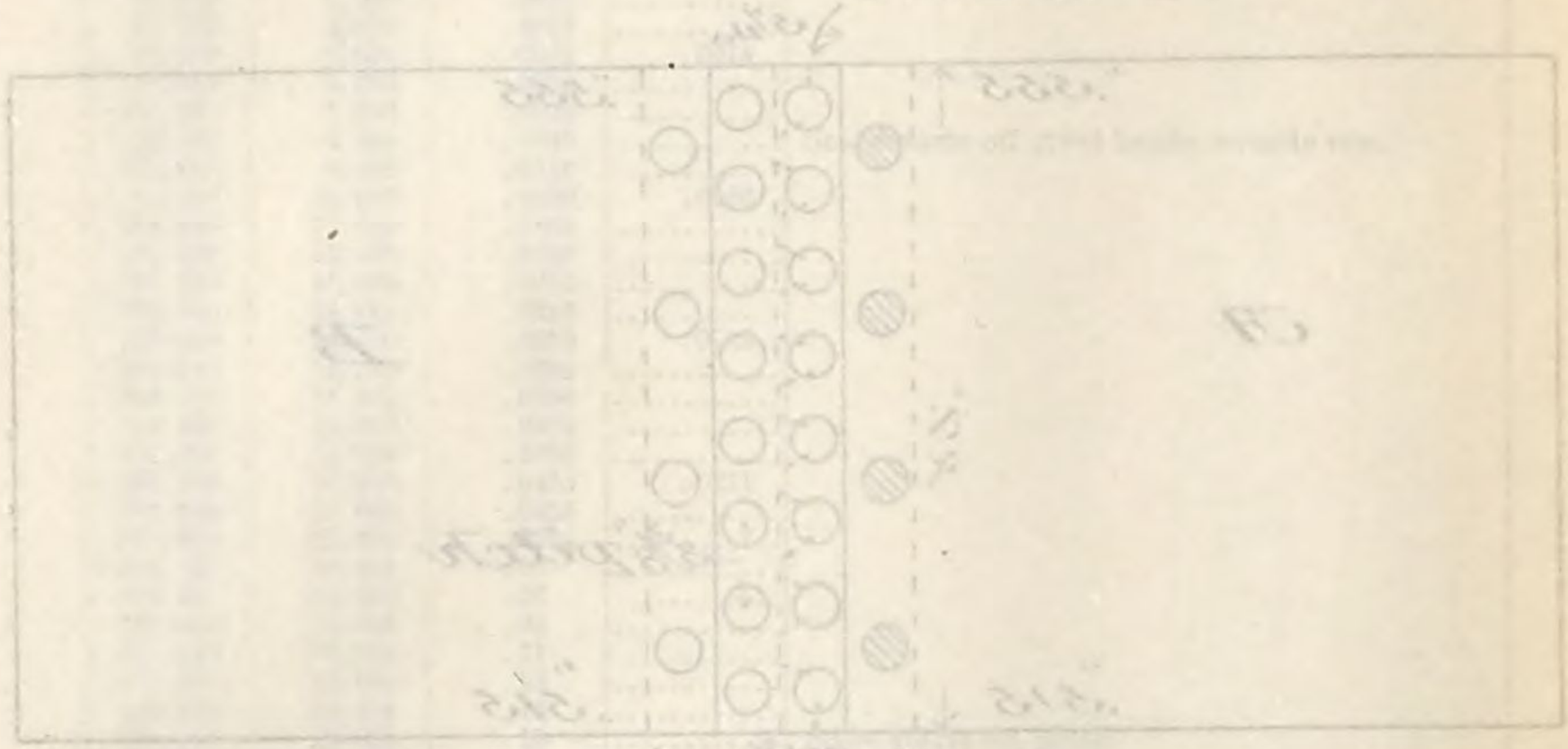
Efficiency of joint, 57.0 per cent.

No. 9377



⅞" steel rivets

15/16" drilled holes



No. 6507.

Original loads.		In gauged length.		Remarks.
Total.	Per square inch.	Increase.	Set.	
Pounds.	Pounds.	Inch.	Inch.	Initial load.
6,000	1,000			
12,000	2,000			
18,000	3,000			
24,000	4,000			
30,000	5,000			
36,000	6,000			
42,000	7,000			
48,000	8,000			
54,000	9,000			
60,000	10,000			
66,000	11,000			
72,000	12,000			
78,000	13,000			
84,000	14,000			
90,000	15,000			
96,000	16,000			
102,000	17,000			
108,000	18,000			
114,000	19,000			
120,000	20,000			
126,000	21,000			
132,000	22,000			
138,000	23,000			
144,000	24,000			
150,000	25,000			
156,000	26,000			
162,000	27,000			
168,000	28,000			
174,000	29,000			
180,000	30,000			

Original length, 20″.

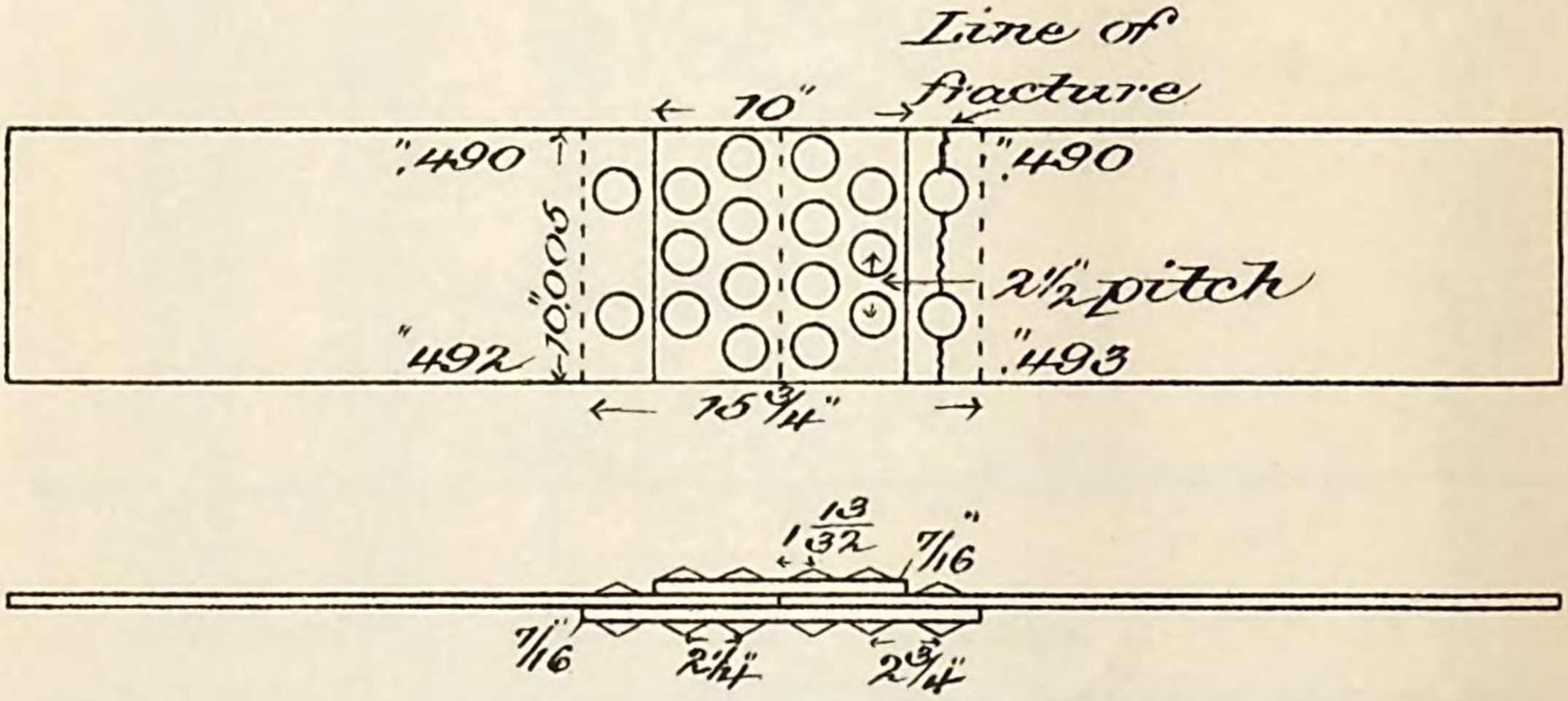
Scale 4″=1 foot at start of rivet heads.
Fractured plate across first row of rivet holes.

Maximum stress per square inch.

Tension on gross section of plate ..... pounds per square inch 30,000
Tension on net section of plate ..... do 32,500
Compression on bearing surface of rivets ..... do 30,000
Shearing on rivets ..... do 30,000

Efficiency of joint, 83.3 per cent.

No 8507



⅞" steel rivets

15/16" drilled holes.

No. 8507.

Gross sectional area of plate	square inches	4.91
Net sectional area of plate	do	3.99
Bearing surface of rivets	do	4.14
Shearing area of rivets	do	11.04

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,910	1,000	0.	0.	Initial load.
9,820	2,000	.0002	.....	
14,730	3,000	.0005	.....	
19,640	4,000	.0010	.....	
24,550	5,000	.0016	0.	
29,460	6,000	.0021	.....	
34,370	7,000	.0028	.....	
39,280	8,000	.0037	.....	
44,190	9,000	.0048	.....	
49,100	10,000	.0060	.0018	
54,010	11,000	.0072	.....	
58,920	12,000	.0089	.....	
63,830	13,000	.0100	.....	
68,740	14,000	.0116	.....	
73,650	15,000	.0127	.0053	
78,560	16,000	.0141	.....	
83,470	17,000	.0155	.....	
88,380	18,000	.0165	.....	
93,290	19,000	.0179	.....	
98,200	20,000	.0190	.0072	
103,110	21,000	.0205	.....	
108,020	22,000	.0218	.....	
112,930	23,000	.0230	.....	
117,840	24,000	.0245	.....	
122,750	25,000	.0260	.0101	
127,660	26,000	.0290	.....	
132,570	27,000	.0311	.....	
137,480	28,000	.0322	.....	
142,390	29,000	.0348	.....	
147,300	30,000	.0375	.0168	
152,210	31,000	.0439	.....	
157,120	32,000	.0495	.....	Scale starts off plate.
162,030	33,000	.06	.....	
166,940	34,000	.07	.....	
171,850	35,000	.09	.....	
176,760	36,000	.14	.....	
181,670	37,000	.20	.....	
186,580	38,000	.23	.....	
191,490	39,000	.26	.....	
196,400	40,000	.29	.....	
201,310	41,000	.32	.....	
206,220	42,000	.36	.....	
211,130	43,000	.40	.....	
216,040	44,000	.44	.....	
220,950	45,000	.49	.....	
225,860	46,000	.53	.....	
230,770	47,000	.60	.....	
235,680	48,000	.66	.....	
240,590	49,000	.74	.....	
245,500	50,000	.84	.....	
248,200	50,550	.92	.....	Tensile strength.

Scale did not start off rivet heads.
Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	50,550
Tension on net section of plate	do	62,200
Compression on bearing surface of rivets	do	59,950
Shearing on rivets	do	22,480

Efficiency of joint, 83.5 per cent.

No. 8506.

Gross sectional area of plate	square inches..	6.73
Net sectional area of plate	do....	5.80
Bearing surface of rivets	do....	4.20
Shearing area of rivets	do....	11.04

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
6,730	1,000	0.	0.	Initial load.
13,460	2,000	.0005	----------	
20,190	3,000	.0008	----------	
26,920	4,000	.0014	----------	
33,650	5,000	.0020	.0007	
40,380	6,000	.0027	----------	
47,110	7,000	.0034	----------	
53,840	8,000	.0043	----------	
60,570	9,000	.0057	----------	
67,300	10,000	.0070	.0035	
74,030	11,000	.0083	----------	
80,760	12,000	.0098	----------	Scale starts off rivet heads.
87,490	13,000	.0109	----------	
94,220	14,000	.0122	----------	
100,950	15,000	.0133	.0071	
107,680	16,000	.0154	----------	
114,410	17,000	.0163	----------	
121,140	18,000	.0181	----------	
127,870	19,000	.0190	----------	
134,600	20,000	.0204	.0099	
141,330	21,000	.0223	----------	
148,060	22,000	.0236	----------	
154,790	23,000	.0252	----------	
161,520	24,000	.0269	----------	
168,250	25,000	.0291	.0142	
174,980	26,000	.0329	----------	
181,710	27,000	.0350	----------	
188,440	28,000	.0375	----------	
195,170	29,000	.0413	----------	
201,900	30,000	.0490	.0286	Scale starts off plate.
208,630	31,000	.06	----------	
215,360	32,000	.07	----------	
222,090	33,000	.10	----------	
228,820	34,000	.15	----------	
235,550	35,000	.20	----------	
242,280	36,000	.26	----------	
249,010	37,000	.30	----------	
255,740	38,000	.35	----------	
262,470	39,000	.38	----------	
269,200	40,000	.42	----------	
275,930	41,000	.48	----------	
282,660	42,000	.52	----------	
289,390	43,000	.59	----------	
296,120	44,000	.66	----------	
302,850	45,000	.72	----------	
309,580	46,000	.84	----------	
316,310	47,000	.94	----------	
323,040	48,000	1.05	----------	
327,200	48,620	----------	----------	Tensile strength.

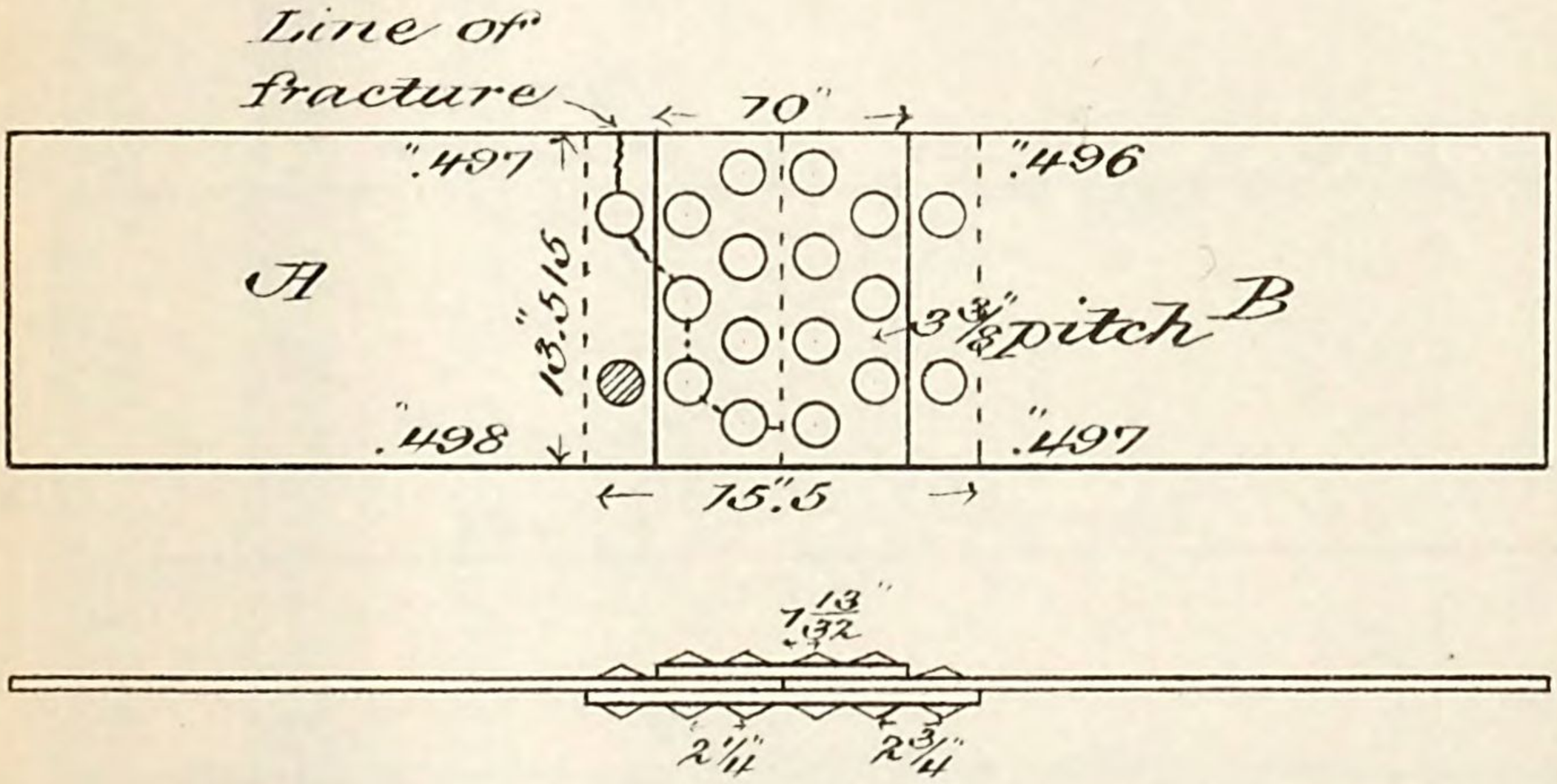
Sheared one rivet, and fractured plate across rivet holes in each row.

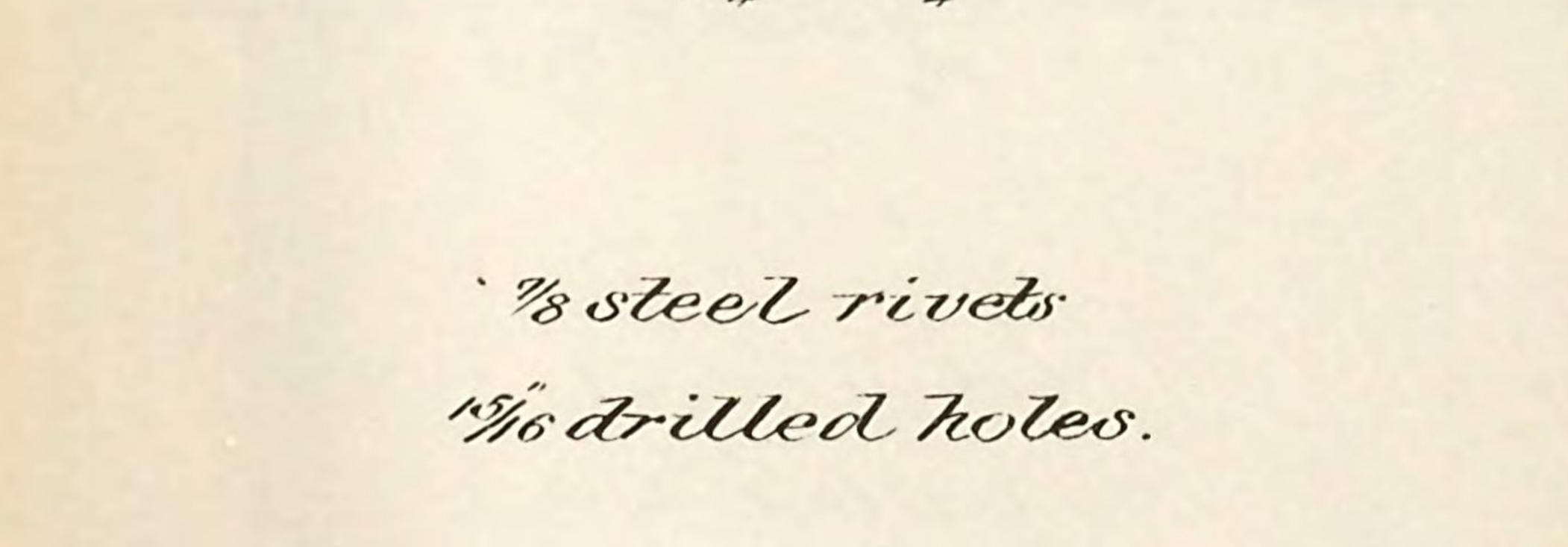
Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	48,620
Tension on net section of plate	do....	56,410
Compression on bearing surface of rivets	do....	77,900
Shearing on rivets	do....	29,640

Efficiency of joint, 80.3 per cent.

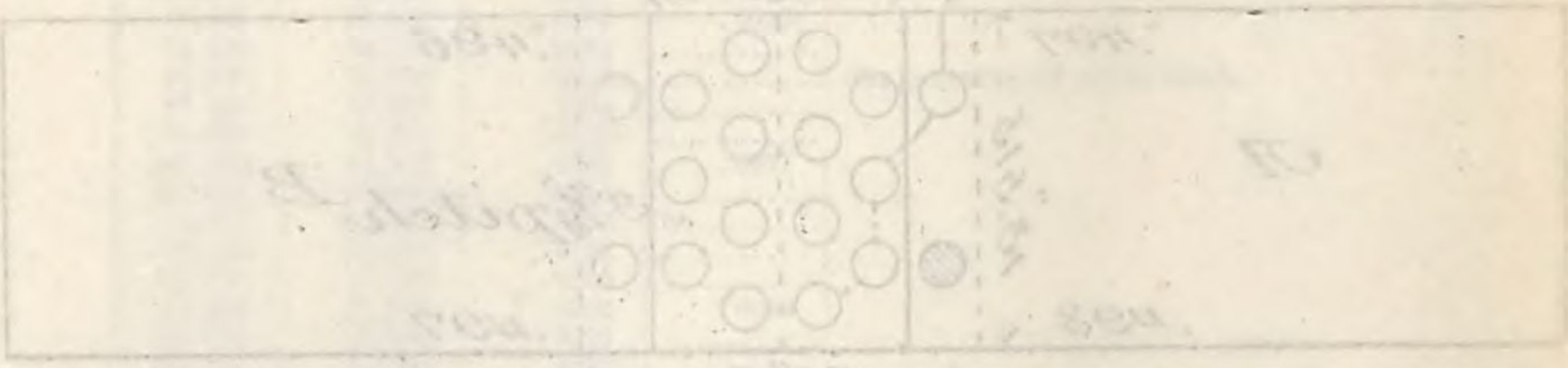
No. 8506

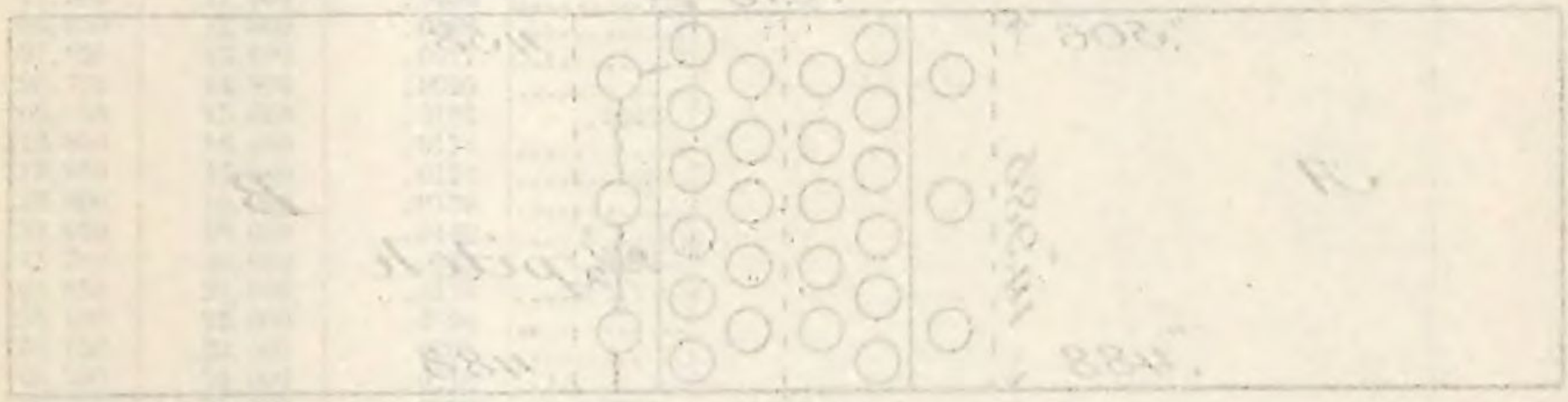




7/8 steel rivets

15/16 drilled holes.





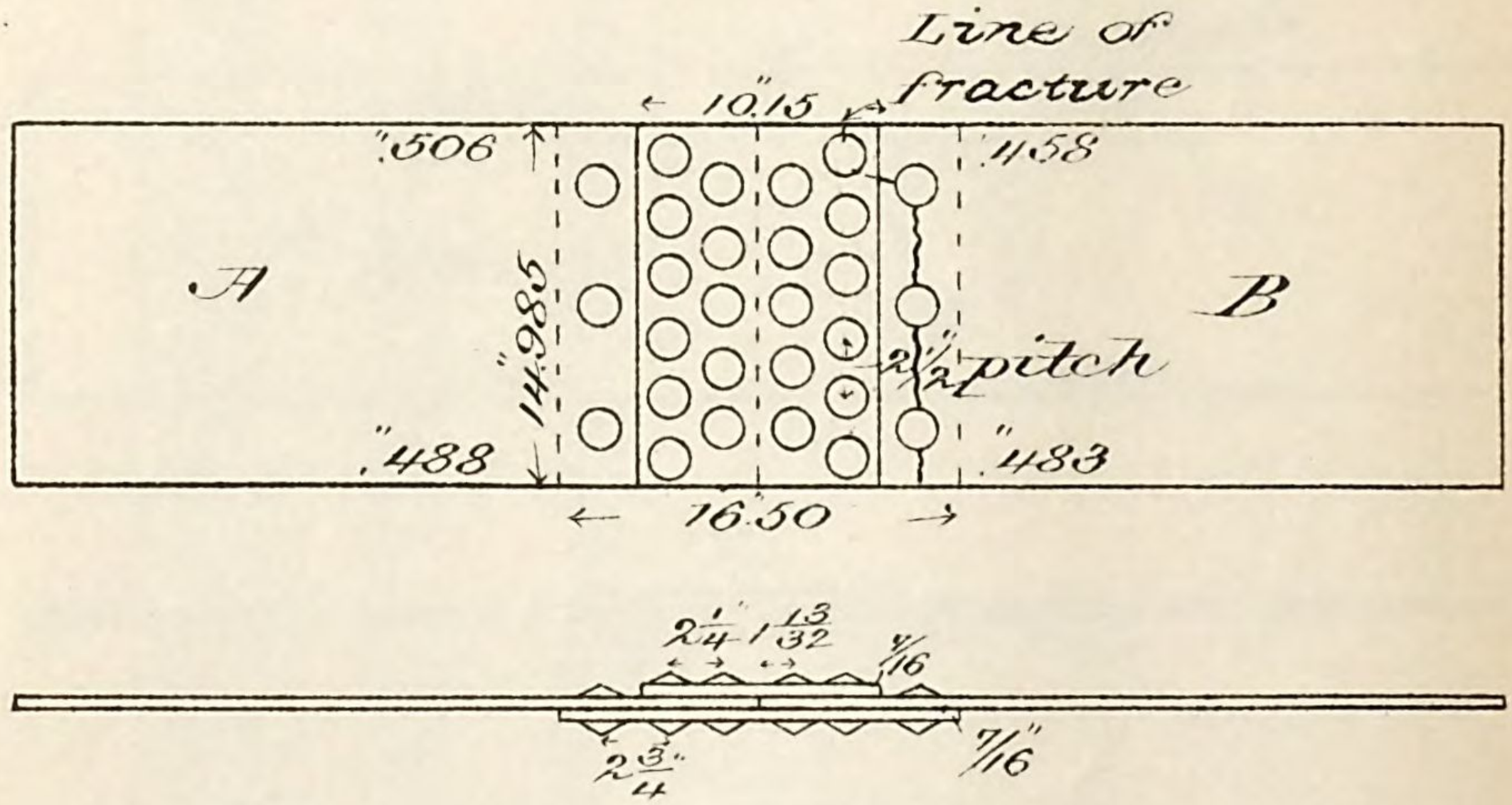
Fractured plate B across outside row of rivet holes, extending to the end rivet of the second row.

Maximum stress on plate.

Tension on gross section of plate ..... pounds per square inch ... 20,000
Tension on net section of plate ..... pounds per square inch ... 25,000
Compression on bearing surface of rivets ..... pounds per square inch ... 40,000
Shearing on rivets ..... pounds per square inch ... 10,000

Efficiency of joint, 80.3 per cent.

No. 8515



⅛" steel rivets

15/16" drilled holes.

No. 8515.

Gross sectional area of plate	square inches	7.05
Net sectional area of plate	do	5.73
Bearing surface of rivets	do	6.17
Shearing area of rivets	do	17.25

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,050	1,000	0.	0.	Initial load.
14,100	2,000	.0003	.....	
21,150	3,000	.0005	.....	
28,200	4,000	.0009	.....	
35,250	5,000	.0014	.0001	
42,300	6,000	.0020	.....	
49,350	7,000	.0025	.....	
56,400	8,000	.0031	.....	
63,450	9,000	.0037	.....	
70,500	10,000	.0046	.0012	
77,550	11,000	.0056	.....	
84,600	12,000	.0066	.....	
91,650	13,000	.0077	.....	
98,700	14,000	.0090	.....	
105,750	15,000	.0101	.0042	
112,800	16,000	.0114	.....	
119,850	17,000	.0124	.....	
126,900	18,000	.0139	.....	
133,950	19,000	.0149	.....	
141,000	20,000	.0163	.0071	
148,050	21,000	.0176	.....	
155,100	22,000	.0190	.....	
162,150	23,000	.0201	.....	
169,200	24,000	.0216	.....	
176,250	25,000	.0232	.0101	
183,300	26,000	.0254	.....	
190,350	27,000	.0276	.....	
197,400	28,000	.0300	.....	
204,450	29,000	.0335	.....	Scale starts off plate.
211,500	30,000	.0407	.0218	
218,550	31,000	.0445	.....	
225,600	32,000	.0489	.....	
232,650	33,000	.0610	.....	
239,700	34,000	.0880	.0649	
246,750	35,000	.10	.....	
253,800	36,000	.13	.....	
260,850	37,000	.18	.....	
267,900	38,000	.22	.....	
274,950	39,000	.25	.....	
282,000	40,000	.28	.....	
289,050	41,000	.31	.....	
296,100	42,000	.35	.....	
303,150	43,000	.39	.....	
310,200	44,000	.44	.....	
317,250	45,000	.47	.....	
324,300	46,000	.53	.....	
331,350	47,000	.59	.....	
338,400	48,000	.66	.....	
345,450	49,000	.72	.....	
352,500	50,000	.84	.....	
359,550	51,000	.96	.....	
361,000	51,205	.....	.....	Tensile strength.

Fractured plate B across outside row of rivet holes, extending to the end rivet of the second row.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	51,205
Tension on net section of plate	do	63,000
Compression on bearing surface of rivets	do	58,510
Shearing on rivets	do	20,930

Efficiency of joint, 85.5 per cent.

No. 8516.

Gross sectional area of plate	square inches	9.93
Net sectional area of plate	do	8.55
Bearing surface of rivets	do	6.43
Shearing area of rivets	do	17.25

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
9,930	1,000	0.	0.	Initial load.
19,860	2,000	.0005	.....	
29,790	3,000	.0010	.....	
39,720	4,000	.0014	.....	
49,650	5,000	.0019	.0009	
59,580	6,000	.0025	.....	
69,510	7,000	.0030	.....	
79,440	8,000	.0036	.....	
89,370	9,000	.0044	.....	
99,300	10,000	.0054	.0022	
109,230	11,000	.0064	.....	
119,160	12,000	.0077	.....	
129,090	13,000	.0093	.....	
139,020	14,000	.0110	.....	
148,950	15,000	.0125	.0056	
158,880	16,000	.0149	.....	
168,810	17,000	.0165	.....	
178,740	18,000	.0179	.....	
188,670	19,000	.0195	.....	
198,600	20,000	.0211	.0096	
208,530	21,000	.0226	.....	
218,460	22,000	.0241	.....	
228,390	23,000	.0260	.....	
238,320	24,000	.0275	.....	
248,250	25,000	.0298	.0140	Scale starts off rivet head, outside row.
258,180	26,000	.0327	.....	Scale starts off plate.
268,110	27,000	.0354	.....	
278,040	28,000	.0380	.....	
287,970	29,000	.0406	.....	
297,900	30,000	.0445	.0234	
307,830	31,000	.0540	.....	
317,760	32,000	.0645	.....	
327,690	33,000	.1050	.....	
337,620	34,000	.1620	.1349	
347,550	35,000	.18	.....	
357,480	36,000	.23	.....	
367,410	37,000	.26	.....	
377,340	38,000	.31	.....	
387,270	39,000	.34	.....	
397,200	40,000	.37	.....	
407,130	41,000	.41	.....	
417,060	42,000	.47	.....	
426,990	43,000	.52	.....	
436,920	44,000	.57	.....	
446,850	45,000	.64	.....	
456,780	46,000	.71	.....	
466,710	47,000	.80	.....	
476,640	48,000	.86	.....	
486,570	49,000	.97	.....	
496,500	50,000	1.07	.....	
506,430	51,000	1.28	.....	
507,300	51,088	.....	.....	Tensile strength.

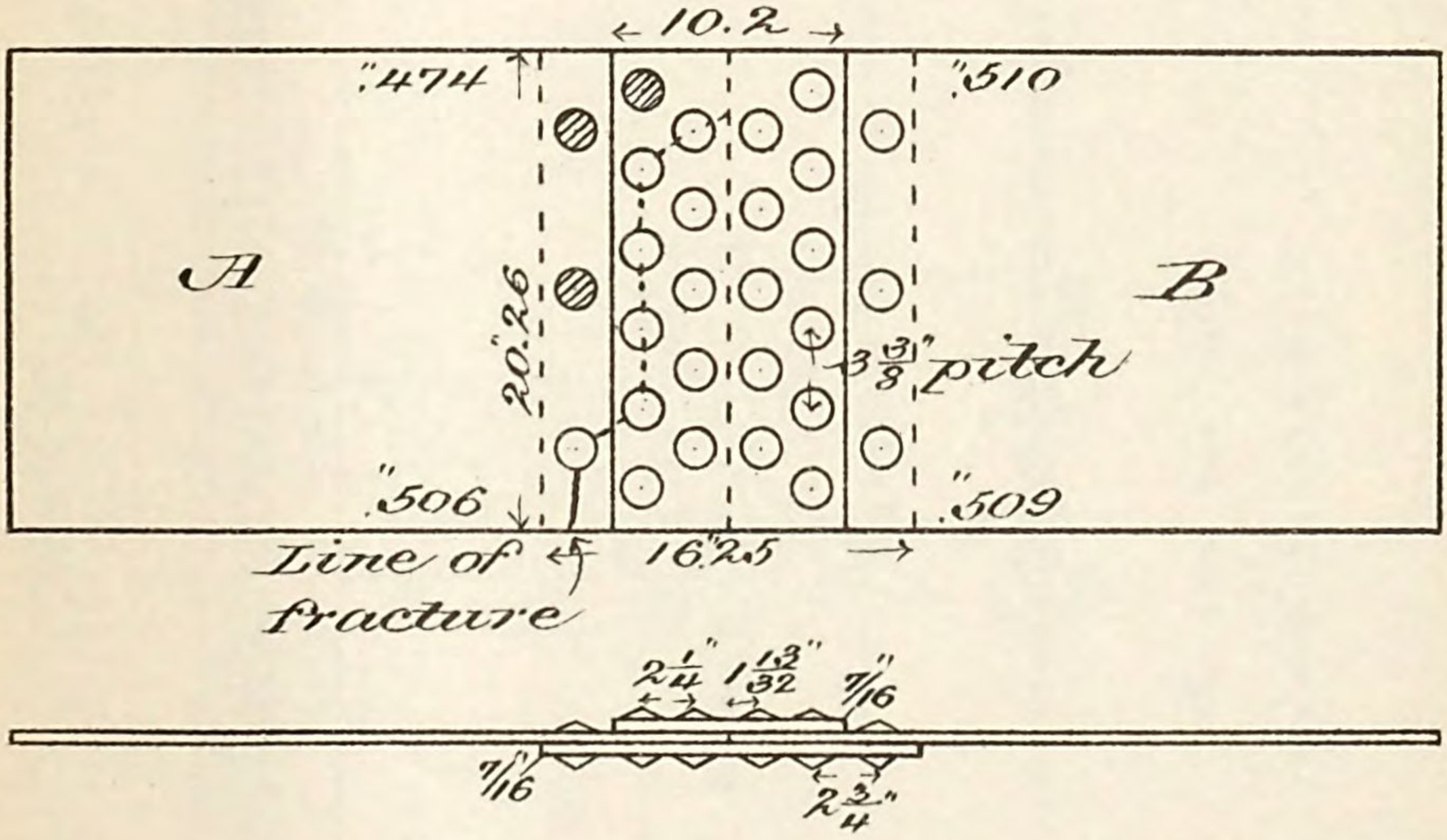
Sheared three rivets and tore plate across rivet holes in each row.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	51,088
Tension on net section of plate	do	59,330
Compression on bearing surface of rivets	do	78,900
Shearing on rivets	do	29,410

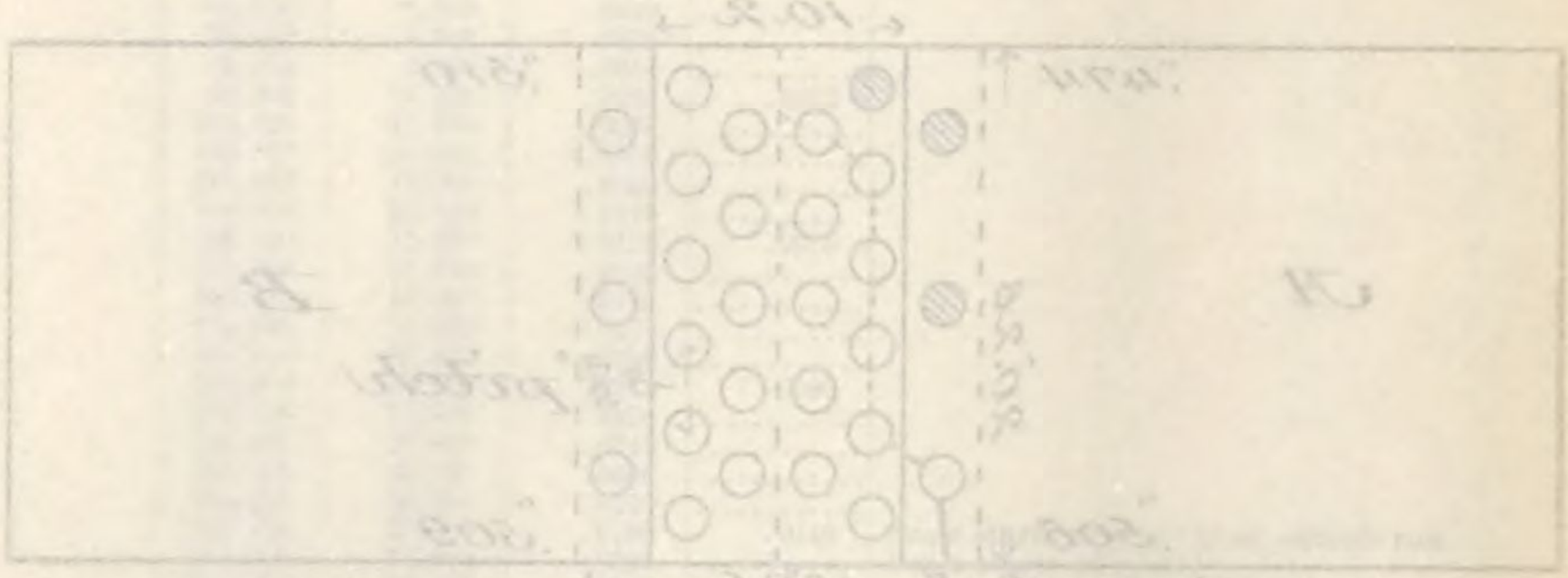
Efficiency of joint, 85.3 per cent.

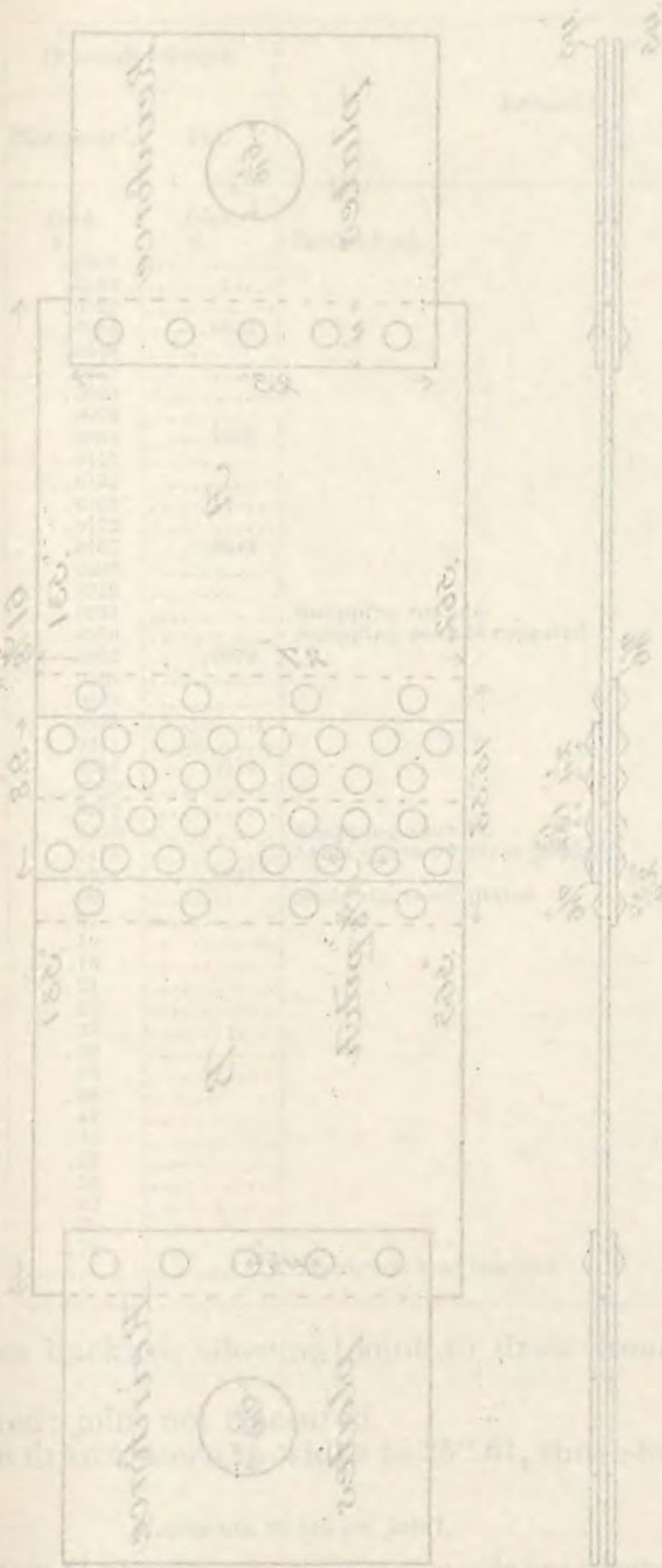
No. 8516



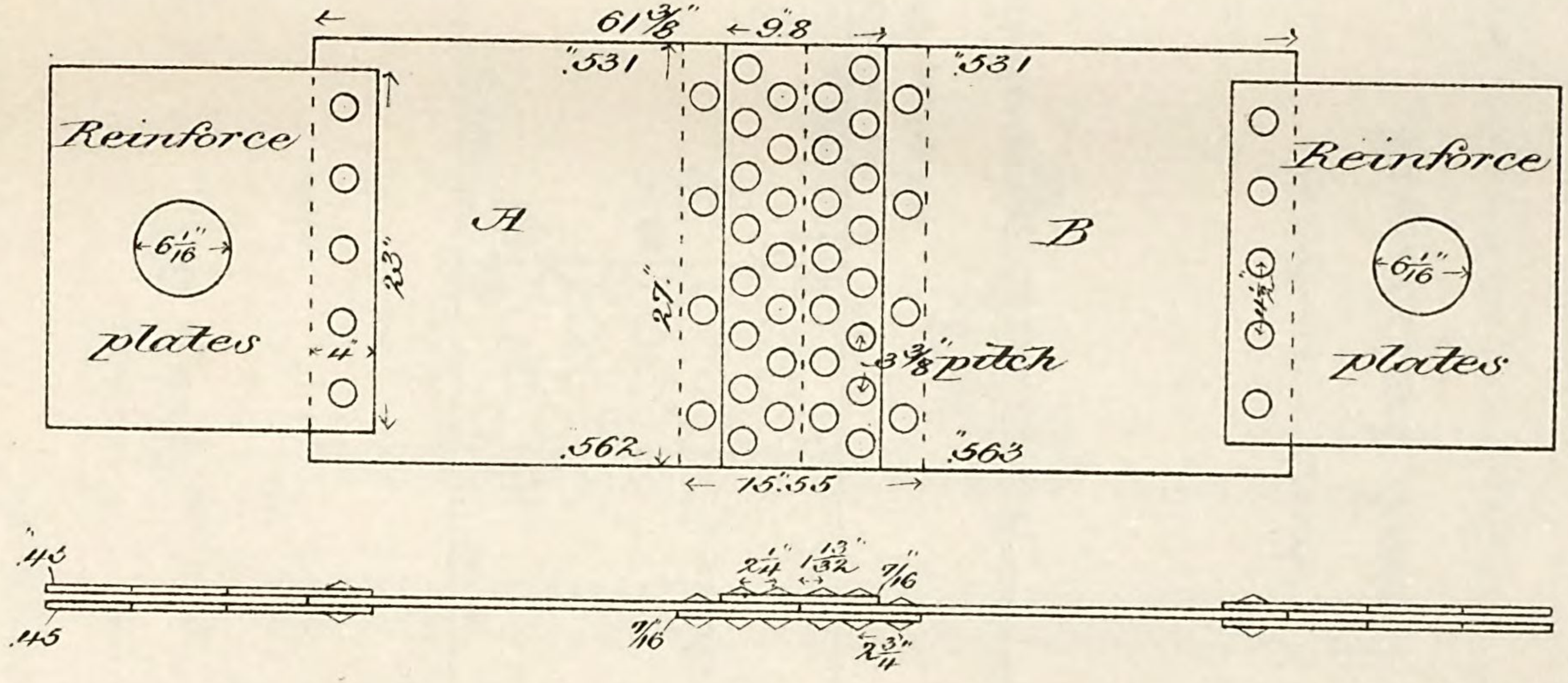
7/8" steel rivets

15/16" drilled holes.





No. 9436.



7/8" steel rivets

15/16" drilled holes.

No. 9436.

Gross sectional area of plate.....square inches.. 14.77
Net sectional area of plate.....do.... 12.72
Bearing surface of rivets.....do.... 9.74
Shearing area of rivets.....do.... 23.46

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,770	1,000	0.	0.	Initial load.
29,540	2,000	.0009	.....	
44,310	3,000	.0018	.....	
59,080	4,000	.0028	.....	
73,850	5,000	.0038	—.0002	
88,620	6,000	.0048	.....	
103,390	7,000	.0053	.....	
118,160	8,000	.0060	.....	
132,930	9,000	.0074	.....	
147,700	10,000	.0093	—.0005	
162,470	11,000	.0112	.....	
177,240	12,000	.0132	.....	
192,010	13,000	.0152	.....	
206,780	14,000	.0172	.....	
221,550	15,000	.0187	.0043	
236,320	16.000	.0206	.....	
251,090	17,000	.0219	.....	
265,860	18,000	.0234	.....	Snapping sounds.
280,630	19,000	.0250	.....	Snapping sounds repeated.
295,400	20,000	.0266	.0075	
310,170	21,000	.0286	.....	
324,940	22,000	.0303	.....	
339,710	23,000	.0322	.....	
354,480	24,000	.0341	.....	
369,250	25,000	.0361	.0119	
384,020	26,000	.0385	.....	
398,790	27,000	.0412	.....	
413,560	28,000	.0439	.....	Snapping sounds.
428,330	29,000	.0473	.....	Scale starts off rivet heads.
443,100	30,000	.0524	.0241	
457,870	31,000	.06	.....	Scale starts off plates.
472,640	32,000	.07	.....	
487,410	33,000	.10	.....	
502,180	34,000	.16	.....	
516,950	35,000	.21	.....	
531,720	36,000	.25	.....	
546,490	37,000	.27	.....	
561,260	38,000	.30	.....	
576,030	39,000	.35	.....	
590,800	40,000	.38	.....	
605,570	41,000	.41	.....	
620,340	42,000	.46	.....	
635,110	43,000	.51	.....	
649,880	44,000	.56	.....	
664,650	45,000	.62	.....	
679,420	46,000	.70	.....	
694,190	47,000	.78	.....	
700,200	47,407	.....	.....	Maximum load reached.

Reenforce plates buckled, allowing joint to draw from the holder jaws.

Test discontinued; joint not fractured.

The plates were drawn down in width to 26″.61, thus showing a contraction of ″.39.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 47,407
Tension on net section of plate.....do.... 55,050
Compression on bearing surface of rivets.....do.... 71,890
Shearing on rivets.....do.... 29,850

Efficiency of joint, 79.4 per cent.

No. 9376.

Gross sectional area of plate	square inches	11.22
Net sectional area of plate	do	10.17
Bearing surface of rivets	do	6.82
Shearing area of rivets	do	14.49

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,220	1,000	0.	0.	Initial load.
22,440	2,000	.0011	.....	
33,660	3,000	.0023	.....	
44,880	4,000	.0036	.....	
56,100	5,000	.0050	.0011	
67,320	6,000	.0064	.....	
78,540	7,000	.0078	.....	
89,760	8,000	.0094	.....	
100,980	9,000	.0111	.....	
112,200	10,000	.0130	.0051	
123,420	11,000	.0149	.....	
134,640	12,000	.0167	.....	
145,860	13,000	.0185	.....	
157,080	14,000	.0202	.....	
168,300	15,000	.0219	.0098	Scale starts off rivet heads.
179,520	16,000	.0236	.....	
190,740	17,000	.0254	.....	
201,960	18,000	.0275	.....	
213,180	19,000	.0291	.....	Scale generally started off the inside rows of rivet heads.
224,400	20,000	.0316	.0140	
235,620	21,000	.0336	.....	
246,840	22,000	.0355	.....	
258,060	23,000	.0376	.....	
269,280	24,000	.0404	.....	
280,500	25,000	.0440	.0208	
291,720	26,000	.0485	.....	
302,940	27,000	.0515	.....	
314,160	28,000	.0558	.....	
325,380	29,000	.0600	.....	
336,600	30,000	.06+	.....	Scale starts off plate.
347,820	31,000	.08	.....	
359,040	32,000	.11	.....	
370,260	33,000	.16	.....	
381,480	34,000	.26	.....	
392,700	35,000	.29	.....	
403,920	36,000	.33	.....	
415,140	37,000	.36	.....	
426,360	38,000	.41	.....	
437,580	39,000	.46	.....	
448,800	40,000	.51	.....	
460,020	41,000	.56	.....	
471,240	42,000	.62	.....	
482,460	43,000	.71	.....	
493,680	44,000	.77	.....	
504,900	45,000	.86	.....	
516,120	46,000	.97	.....	
522,100	46,530	.....	.....	Tensile strength.

Sheared 5 rivets in plate B and tore out plate in front of rivet holes at inside row.

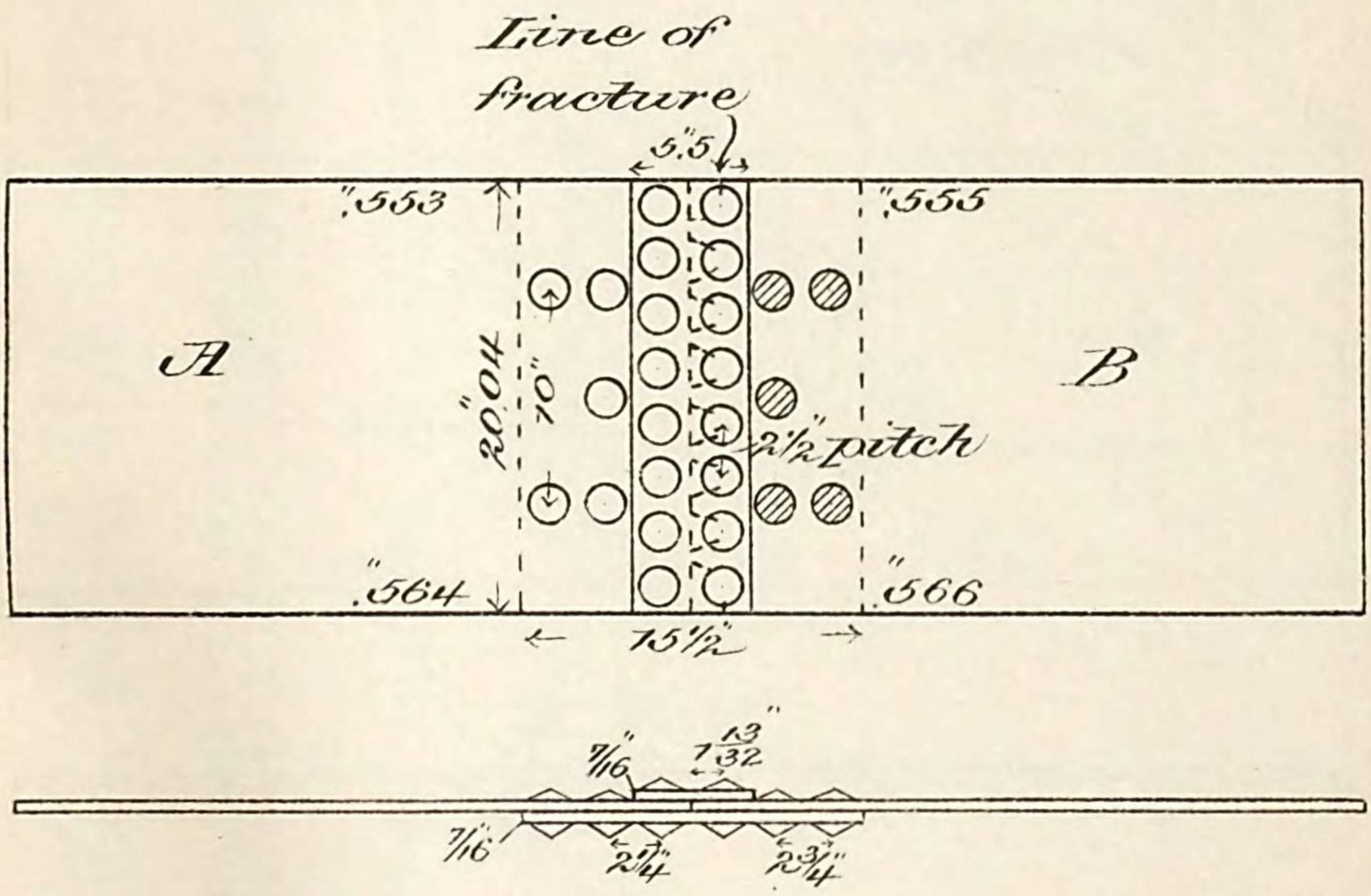
Elongation of rivet holes....	First row	″.19
	Second row, end holes	.15
	Second row, middle hole	.24

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	46,530
Tension on net section of plate	do	51,340
Compression on bearing surface of rivets	do	76,550
Shearing on rivets	do	36,030

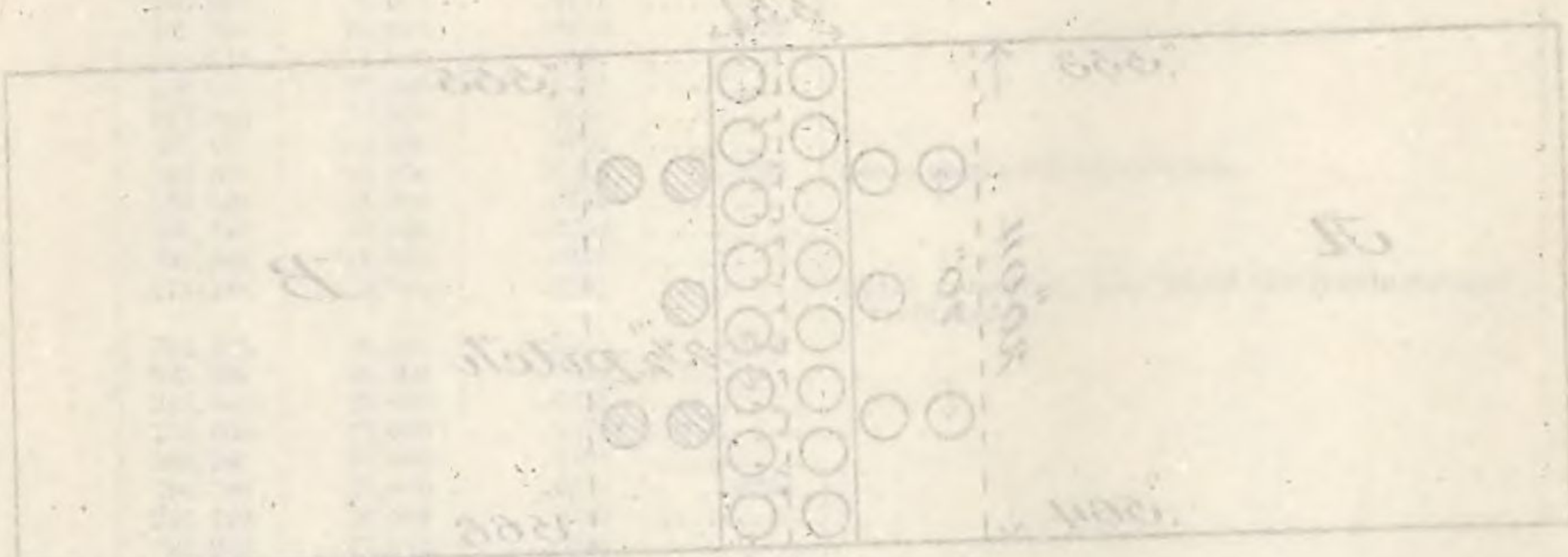
Efficiency of joint, 78.0 per cent.

No. 9376

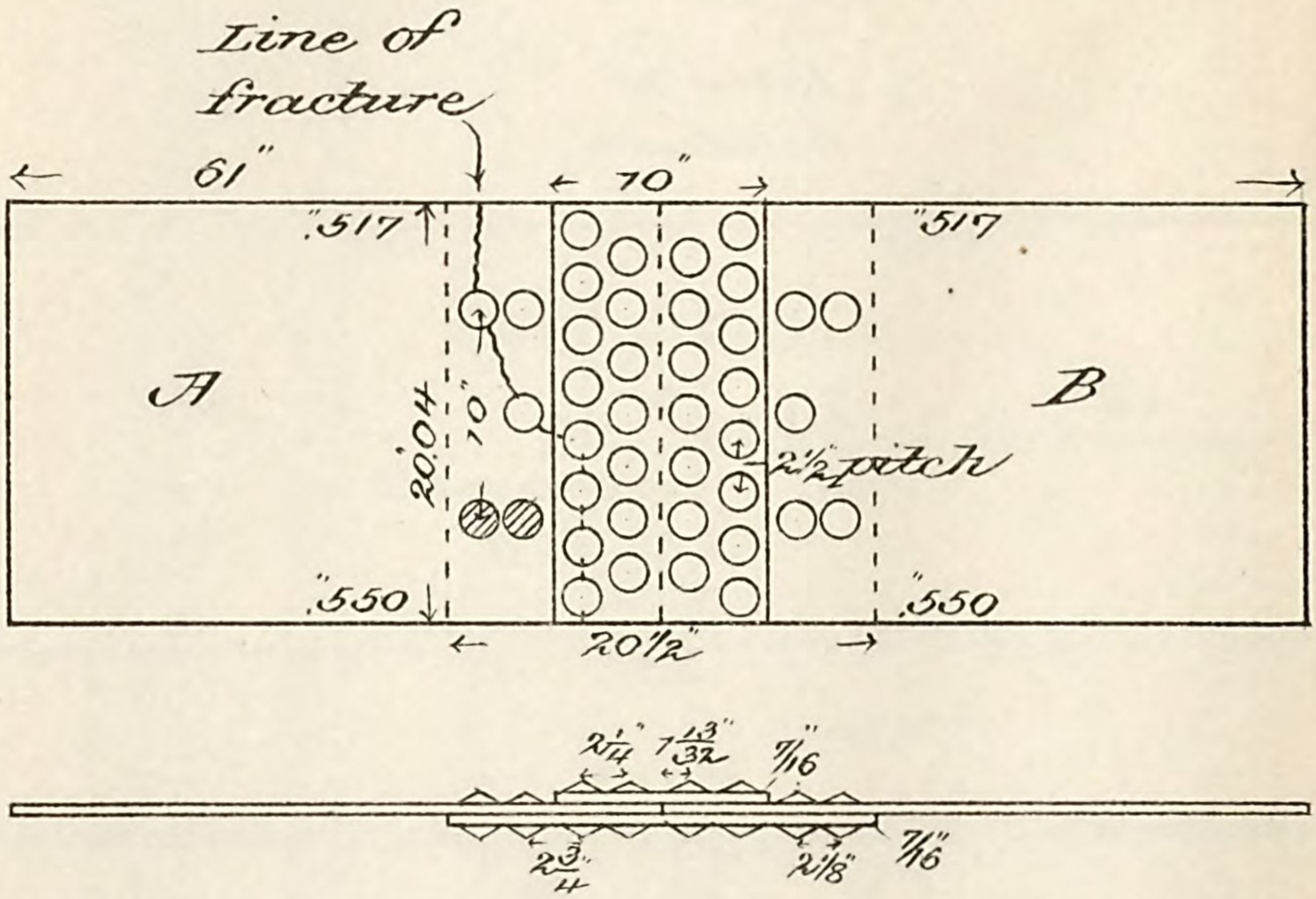


7/8" steel rivets

15/16 drilled holes



No. 9375



7/8" steel rivets

15/16 drilled holes

No. 9375.

Gross sectional area of plate.....square inches.. 10.70
Net sectional area of plate.....do.... 9.63
Bearing surface of rivets.....do.... 10.01
Shearing area of rivets.....do.... 24.15

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
10,700	1,000	0.	0.	Initial load.
21,400	2,000	.0010	.....	
32,100	3,000	.0018	.....	
42,800	4,000	.0025	.....	
53,500	5,000	.0034	.0003	
64,200	6,000	.0042	.....	
74,900	7,000	.0052	.....	
85,600	8,000	.0060	.....	
96,300	9,000	.0072	.....	
107,000	10,000	.0083	.0012	
117,700	11,000	.0091	.....	
128,400	12,000	.0103	.....	
139,100	13,000	.0116	.....	
149,800	14,000	.0127	.....	
160,500	15,000	.0156	.0043	
171,200	16,000	.0187	.....	
181,900	17,000	.0213	.....	
192,600	18,000	.0232	.....	
203,300	19,000	.0260	.....	
214,000	20,000	.0284	.....	
224,700	21,000	.0304	.....	
235,400	22,000	.0329	.....	Scale starts off rivets first and second rows, plate A.
246,100	23,000	.0343	.....	
256,800	24,000	.0368	.....	
267,500	25,000	.0390	.0136	
278,200	26,000	.0418	.....	
288,900	27,000	.0439	.....	
299,600	28,000	.0465	.....	Scale starts off plates.
310,300	29,000	.0494	.....	
321,000	30,000	.0524	.0205	
331,700	31,000	.0578	.....	
342,400	32,000	.06	.....	
353,100	33,000	.07	.....	
363,800	34,000	.10	.....	
374,500	35,000	.13	.....	
385,200	36,000	.16	.....	
395,900	37,000	.18	.....	
406,600	38,000	.20	.....	
417,300	39,000	.23	.....	
428,000	40,000	.26	.....	
438,700	41,000	.29	.....	
449,400	42,000	.31	.....	
460,100	43,000	.36	.....	
470,800	44,000	.40	.....	
481,500	45,000	.44	.....	
492,200	46,000	.50	.....	
502,200	46,930	.....	.....	Tensile strength.

Fractured plate A through one rivet hole in first row, one in the second row, and four in the third row of rivet holes.

The fracture was visible at the edge of the plate opposite the third row of rivets, after which fractures were in sight at the sides of the rivet holes in the first and second rows. Finally these lines of fracture extended toward each other and completed the fracture of the plate. Appearance silky, slightly lamellar. Sheared 2 rivets.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 46,930
Tension on net section of plate.....do.... 52,150
Compression on bearing surface of rivets.....do.... 50,170
Shearing on rivets.....do.... 20,790

Efficiency of joint, 78.6 per cent.

No. 8508.

Joint tested hot.

Gross sectional area of plate	square inches..	7.35
Net sectional area of plate	do....	6.43
Bearing surface of rivets	do....	7.34
Shearing area of rivets	do....	18.63

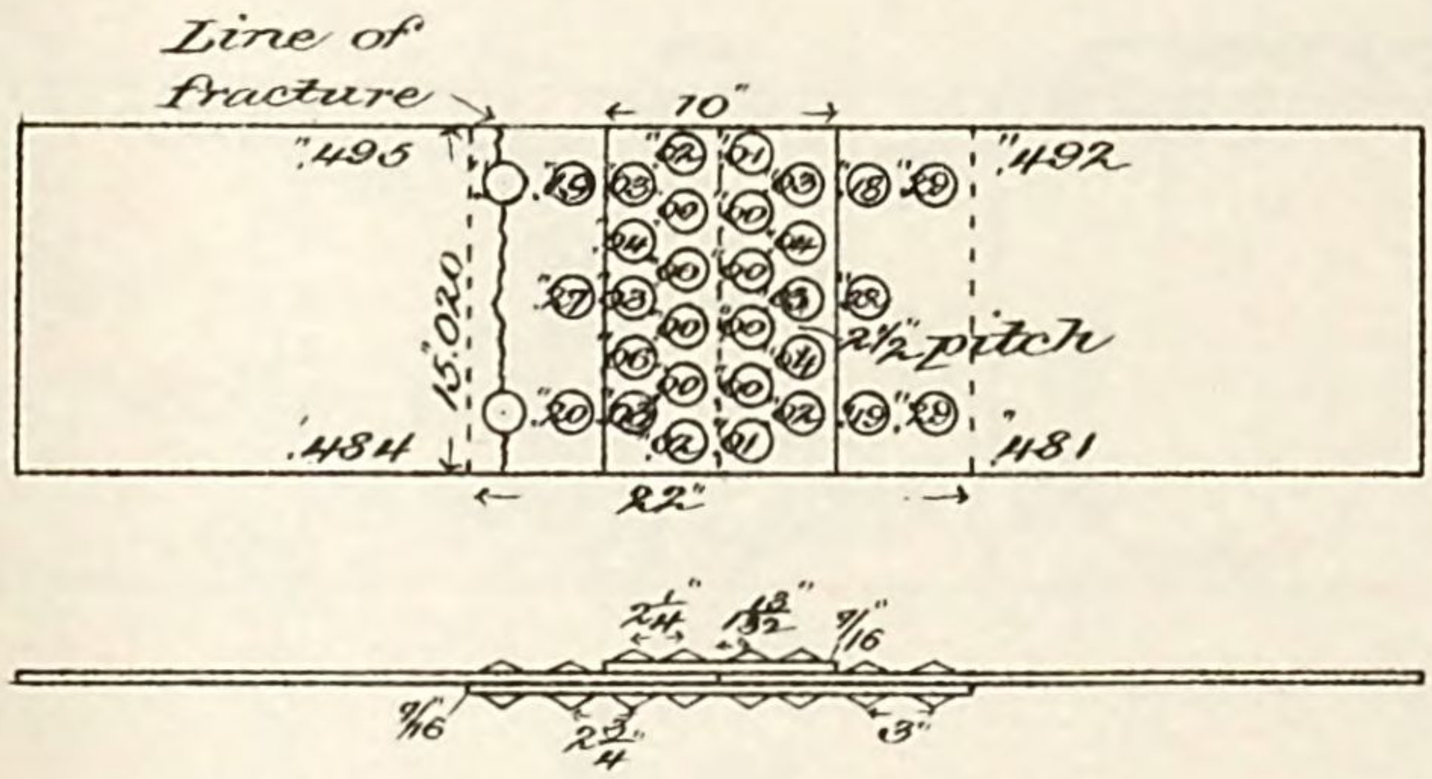
Temperature of joint about 410° F.
Tensile strength, 401,200 pounds=54,580 pounds per square inch.
Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	54,580
Tension on net section of plate	do....	62,390
Compression on bearing surface of rivets	do....	54,660
Shearing on rivets	do....	21,530

Efficiency of joint, 90.1 per cent.

No. 8508

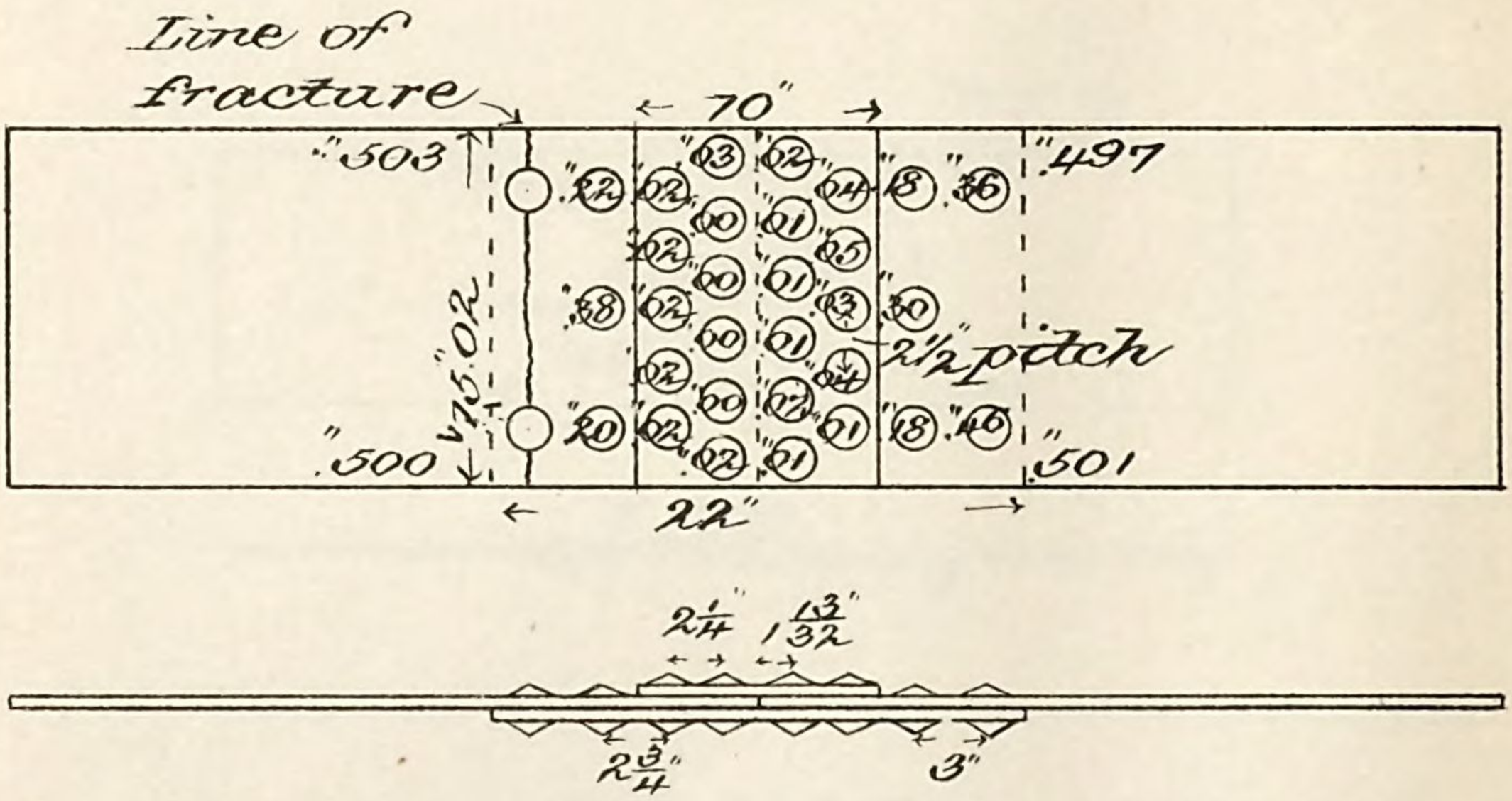


⅞" steel rivets

15/16 drilled holes.

Elongation of rivet holes after fracture, shown by the figures on the rivet heads.

No. 8509



7/8" steel rivets

15/16" drilled holes.

No. 8509.

Gross sectional area of plate.....square inches.. 7.49
Net sectional area of plate.....do.... 6.56
Bearing surface of rivets.....do.... 7.48
Shearing area of rivets.....do.... 18.63

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,490	1,000	0.	0.	Initial load.
14,980	2,000	.0004	.....	
22,470	3,000	.0009	.....	
29,960	4,000	.0019	.....	
37,450	5,000	.0026	.0007	
44,940	6,000	.0034	.....	
52,430	7,000	.0043	.....	
59,920	8,000	.0052	.....	
67,410	9,000	.0063	.....	
74,900	10,000	.0074	.0029	
82,390	11,000	.0088	.....	
89,880	12,000	.0099	.....	
97,370	13,000	.0114	.....	
104,860	14,000	.0128	.....	
112,350	15,000	.0145	.0068	
119,840	16,000	.0158	.....	
127,330	17,000	.0170	.....	
134,820	18,000	.0182	.....	
142,310	19,000	.0196	.....	
149,800	20,000	.0209	.0095	
157,290	21,000	.0224	.....	
164,780	22,000	.0236	.....	
172,270	23,000	.0252	.....	
179,760	24,000	.9264	.....	
187,250	25,000	.0279	.0125	
194,740	26,000	.0302	.....	
202,230	27,000	.0322	.....	
209,720	28,000	.0346	.....	
217,210	29,000	.0372	.....	
224,700	30,000	.0395	.0191	
232,190	31,000	.0435	.....	
239,680	32,000	.0490	.....	
247,170	33,000	.07	.....	
254,660	34,000	.08	.....	
262,150	35,000	.09	.....	
269,640	36,000	.11	.....	
277,130	37,000	.13	.....	
284,620	38,000	.16	.....	
292,110	39,000	.17	.....	
299,600	40,000	.19	.....	
307,090	41,000	.22	.....	
314,580	42,000	.25	.....	
322,070	43,000	.26	.....	
329,560	44,000	.30	.....	
337,050	45,000	.34	.....	
344,540	46,000	.37	.....	
352,030	47,000	.41	.....	
359,520	48,000	.46	.....	
367,010	49,000	.51	.....	
374,500	50,000	.56	.....	
381,990	51,000	.64	.....	
384,100	51,282	.....	.....	Tensile strength.

Fractured plate across first row of rivet holes.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 51,282
Tension on net section of plate.....do.... 58,550
Compression on bearing surface of rivets.....do.... 51,350
Shearing on rivets.....do.... 20,620

Efficiency of joint, 84.7 per cent.

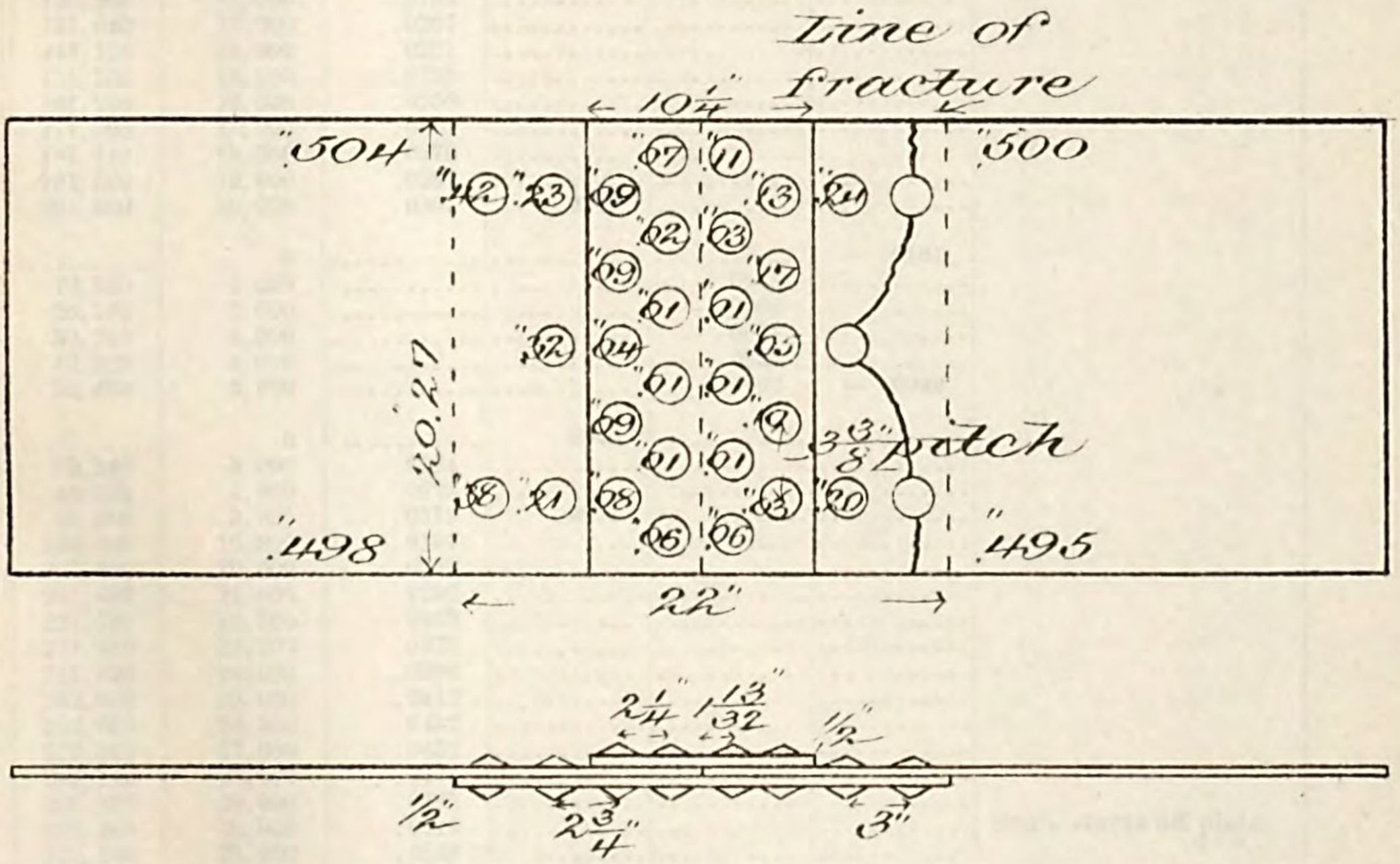
No. 8510.

Gross sectional area of plate ..... square inches.. 10.78
Net sectional area of plate ..... do.... 9.15
Bearing surface of rivets ..... do.... 7.46
Shearing area of rivets ..... do.... 18.63

Gauged length, 20″.

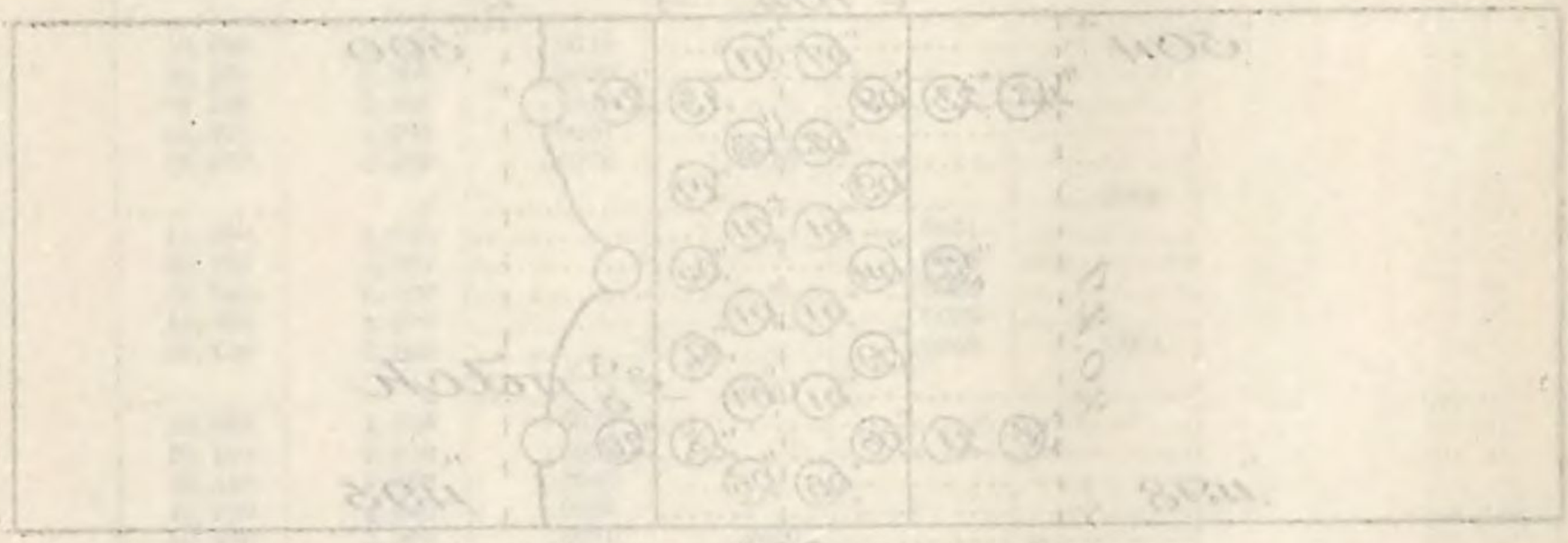
Applied loads.		Tension loads.		Compression loads.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
0	0	0.	0.	.....	.....	
10,080	1,000	.0011	.....	.....	.....	
20,160	2,000	.0021	.....	.....	.....	
30,240	3,000	.0034	.....	.....	.....	
40,320	4,000	.0048	.....	.....	.....	
50,400	5,000	.0069	.0011	.....	.....	
.....	0	.....	.....	.....	— 0.0011	
10,080	1,000	.....	.....	0.0005	.....	
20,160	2,000	.....	.....	.0017	.....	
30,240	3,000	.....	.....	.0026	.....	
40,320	4,000	.....	.....	.0038	.....	
50,400	5,000	.....	.....	.0050	— .0004	
.....	0	.....	.0004	.....	.....	
10,080	1,000	.0018	.....	.....	.....	
20,160	2,000	.0030	.....	.....	.....	
30,240	3,000	.0048	.....	.....	.....	
40,320	4,000	.0061	.....	.....	.....	
50,400	5,000	.0078	.0016	.....	.....	
.....	0	.....	.....	.....	— .0016	
10,080	1,000	.....	.....	— .0001	.....	
20,160	2,000	.....	.....	.0012	.....	
30,240	3,000	.....	.....	.0024	.....	
40,320	4,000	.....	.....	.0036	.....	
50,400	5,000	.....	.....	.0049	— .0001	
.....	0	.....	.0001	.....	.....	
10,080	1,000	.0021	.....	.....	.....	
20,160	2,000	.0034	.....	.....	.....	
30,240	3,000	.0049	.....	.....	.....	
40,320	4,000	.0064	.....	.....	.....	
50,400	5,000	.0079	.0020	.....	.....	
.....	0	.....	.....	.....	— .0016	
10,080	1,000	.....	.....	— .0001	.....	
20,160	2,000	.....	.....	.0011	.....	
30,240	3,000	.....	.....	.0022	.....	
40,320	4,000	.....	.....	.0035	.....	
50,400	5,000	.....	.....	.0048	— .0001	
.....	0	.....	.0001	.....	.....	
10,080	1,000	.0019	.....	.....	.....	
20,160	2,000	.0035	.....	.....	.....	
30,240	3,000	.0049	.....	.....	.....	
40,320	4,000	.0065	.....	.....	.....	
50,400	5,000	.0079	.....	.....	.....	
60,480	6,000	.0095	.....	.....	.....	
70,560	7,000	.0109	.....	.....	.....	
80,640	8,000	.0126	.....	.....	.....	
90,720	9,000	.0144	.....	.....	.....	
100,800	10,000	.0161	.0046	.....	.....	
.....	0	.....	.....	.....	— .0046	
10,080	1,000	.....	.....	— .0029	.....	
20,160	2,000	.....	.....	— .0015	.....	
30,240	3,000	.....	.....	.0000	.....	
40,320	4,000	.....	.....	+ .0017	.....	
50,400	5,000	.....	.....	.0034	— .0012	
.....	0	.....	.0012	.....	.....	
10,080	1,000	.0024	.....	.....	.....	
20,160	2,000	.0035	.....	.....	.....	
30,240	3,000	.0050	.....	.....	.....	
40,320	4,000	.0061	.....	.....	.....	
50,400	5,000	.0079	.0029	.....	.....	
60,480	6,000	.0105	.....	.....	.....	
70,560	7,000	.0124	.....	.....	.....	
80,640	8,000	.0138	.....	.....	.....	
90,720	9,000	.0152	.....	.....	.....	
100,800	10,000	.0164	.0046	.....	.....	
.....	0	.....	.....	.....	— .0046	

No. 8510



7/8" steel rivets

15/16" drilled holes.



Applied loads.		Tension loads.		Compression loads.		Remarks.
Total.	Per square inch.	Elongation.	Set.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
10,080	1,000	.....	.....	— .0030	.....	
20,160	2,000	.....	.....	— .0016	.....	
30,240	3,000	.....	.....	+ .0001	.....	
40,320	4,000	.....	.....	.0017	.....	
50,400	5,000	.....	.....	.0034	— .0013	
.....	0	.....	.0013	.....	.....	
10,080	1,000	.0026	.....	.....	.....	
20,160	2,000	.0037	.....	....	.....	
30,240	3,000	.0051	.....	.....	.....	
40,320	4,000	.0065	.....	.....	.....	
50,400	5,000	.0084	.....	.....	.....	
60,480	6,000	.0108	.....	.....	.....	
70,560	7,000	.0128	.....	.....	.....	
80,640	8,000	.0141	.....	.....	.....	
90,720	9,000	.0154	.....	.....	.....	
100,800	10,000	.0165	.....	.....	.....	
110,880	11,000	.0181	.....	.....	.....	
120,960	12,000	.0194	.....	.....	.....	
131,040	13,000	.0207	.....	.....	.....	
141,120	14,000	.0221	.....	.....	.....	
151,200	15,000	.0235	.....	.....	.....	
161,280	16,000	.0250	.....	.....	.....	
171,360	17,000	.0264	.....	.....	.....	
181,440	18,000	.0279	.....	.....	.....	
191,520	19,000	.0291	.....	.....	.....	
201,600	20,000	.0307	.0101	.....	.....	
.....	0	.....	.....	.....	— .0101	
10,080	1,000	.....	.....	— .0083	.....	
20,160	2,000	.....	.....	— .0068	.....	
30,240	3,000	.....	.....	— .0051	.....	
40,320	4,000	.....	.....	— .0028	.....	
50,400	5,000	.....	.....	— .0002	— .0049	
.....	0	.....	.0049	.....	.....	
30,240	3,000	.0084	.....	.....	.....	
40,320	4,000	.0098	.....	.....	.....	
50,400	5,000	.0112	.0071	.....	.....	
100,800	10,000	.0197	.....	.....	.....	
201,600	20,000	.0312	.....	.....	.....	
211,680	21,000	.0336	.....	.....	.....	
221,760	22,000	.0352	.....	.....	.....	
231,840	23,000	.0373	.....	.....	.....	
241,920	24,000	.0390	.....	.....	.....	
252,000	25,000	.0412	.....	.....	.....	
262,080	26,000	.0432	.....	.....	.....	
272,160	27,000	.0452	.....	.....	.....	
282,240	28,000	.0471	.....	.....	.....	
292,320	29,000	.0495	.....	.....	.....	
302,400	30,000	.0514	.....	.....	.....	Scale starts off plate.
312,480	31,000	.0538	.....	.....	.....	
322,560	32,000	.06	.....	.....	.....	
342,720	34,000	.07	.....	.....	.....	
362,880	36,000	.10	.....	.....	.....	
383,040	38,000	.16	.....	.....	.....	
403,200	40,000	.22	.....	.....	.....	
423,360	42,000	.28	.....	.....	.....	
443,520	44,000	.35	.....	.....	.....	
463,680	46,000	.42	.....	.....	.....	
483,840	48,000	.53	.....	.....	.....	
503,500	49,960	.....	.....	.....	.....	Tensile strength.

Fractured plate B across rivet holes in first and second row. Appearance, silky.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	49,960
Tension on net section of plate	do....	55,030
Compression on bearing surface of rivets	do....	67,490
Shearing on rivets	do....	27,030

Efficiency of joint, 82.5 per cent.

No. 9437.

Gross sectional area of plate	square inches	15.08
Net sectional area of plate	do	13.88
Bearing surface of rivets	do	10.45
Shearing area of rivets	do	24.15

Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
15,080	1,000	0.	0.	Initial load.
30,160	2,000	.0007	----------	
45,240	3,000	.0013	----------	
60,320	4,000	.0019	----------	
75,400	5,000	.0026	0.	
90,480	6,000	.0032	----------	
105,560	7,000	.0042	----------	
120,640	8,000	.0052	----------	
135,720	9,000	.0064	----------	
150,800	10,000	.0082	.0022	
165,880	11,000	.0097	----------	
180,960	12,000	.0113	----------	
196,040	13,000	.0129	----------	Scale starts off rivet heads in middle row of rivets (row of 3).
211,120	14,000	.0149	----------	
226,200	15,000	.0165	.0068	
241.280	16,000	.0184	----------	
256,360	17,000	.0199	----------	
271,440	18,000	.0217	----------	
286,520	19,000	.0230	----------	
301,600	20,000	.0248	.0113	
316,680	21.000	.0267	----------	
331,760	22,000	.0278	----------	
346,840	23,000	.0299	----------	
361,920	24,000	.0317	----------	
377,000	25,000	.0337	.0157	
392,080	26,000	.0363	----------	
407,160	27,000	.0386	----------	
422,240	28,000	.0408	----------	Scale starts off plate.
437,320	29,000	.0441	----------	
452,400	30,000	.0479	.0255	
467,480	31,000	.0557	----------	
482,560	32,000	.07	----------	
497,640	33,000	.09	----------	
512,720	34,000	.12	----------	
527,800	35,000	.16	----------	
542,880	36,000	.19	----------	
557,960	37,000	.23	----------	
573,040	38,000	.26	----------	
588,120	39,000	.29	----------	
603,200	40,000	.33	----------	
618,280	41,000	.36	----------	
633,360	42,000	.41	----------	
640,000	42,440		----------	Maximum load applied.

Reenforce plates buckled, allowing joint to draw from the holder jaws. Test discontinued. Joint not fractured.

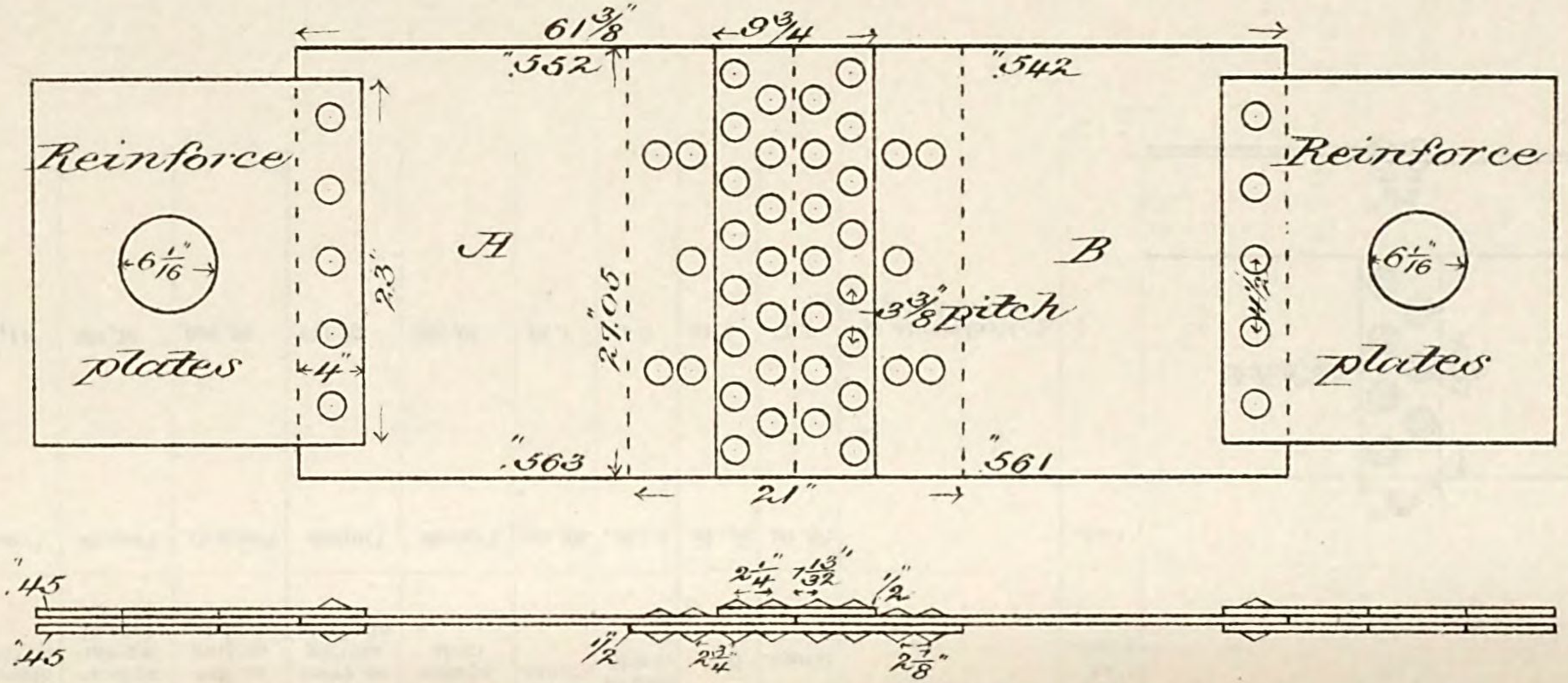
The plates were drawn down in width to 26″.80 and 26″.78, thus showing contractions of ″.20 and ″.22 respectively.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch	42,440
Tension on net section of plate	do	46,110
Compression on bearing surface of rivets	do	61,240
Shearing on rivets	do	26,500

Efficiency of joint, 71.1 per cent.

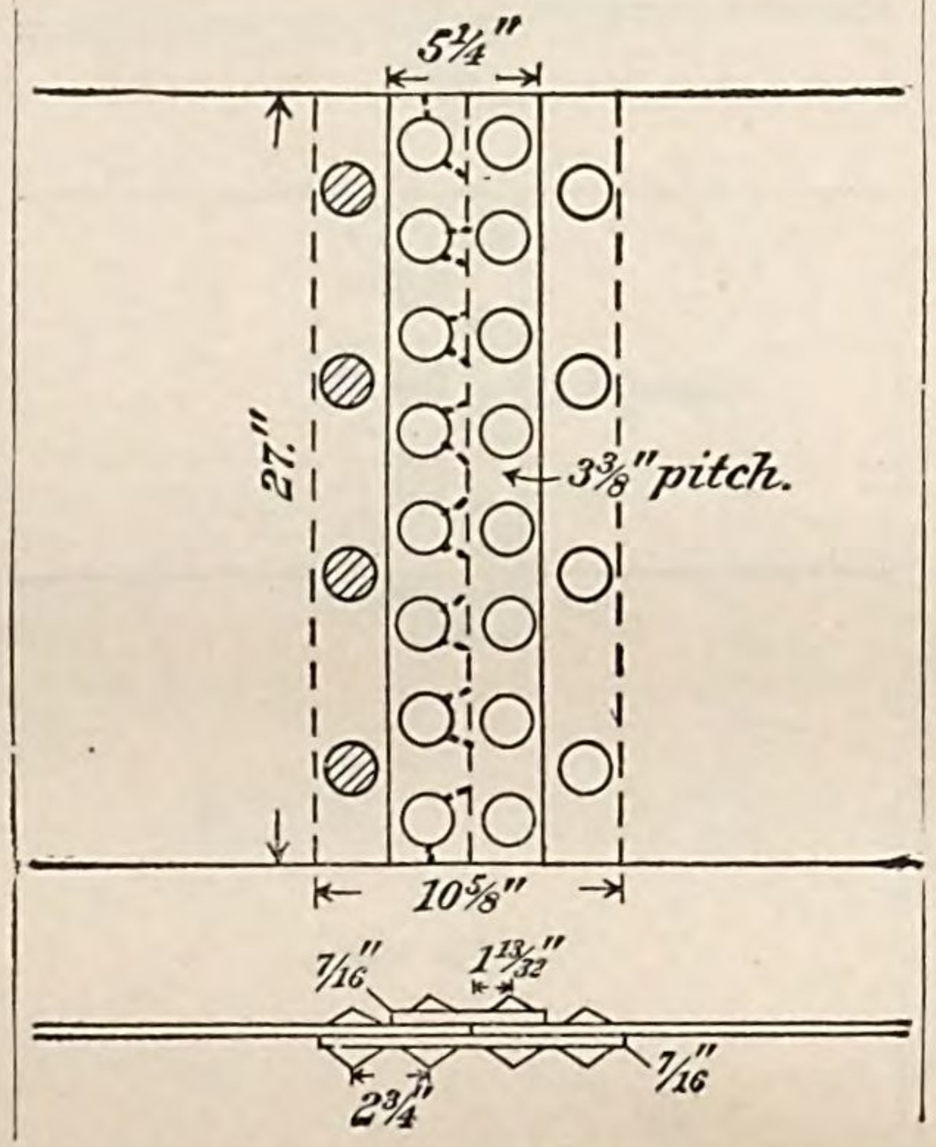
No. 9437



7/8" steel rivets

15/16" drilled holes.

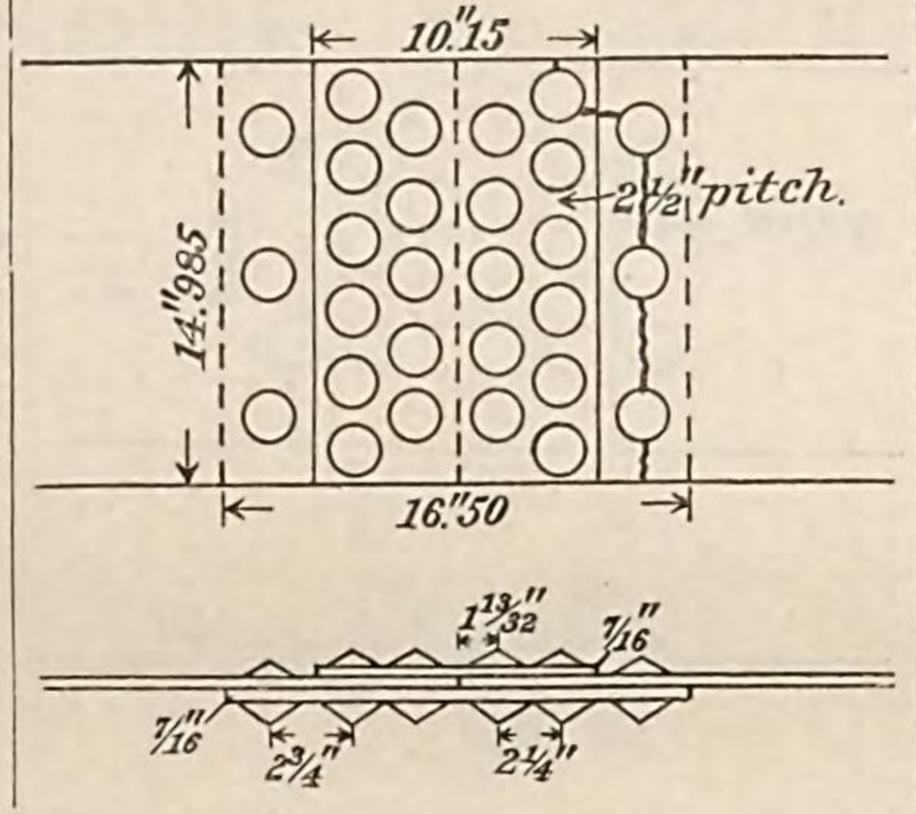
TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
9377		½	⅞" steel rivets, 15/16" drilled holes.	14.44	12.44	6.02	13.80	59,680	33,990	39,450	**81,530**	**35,560**	57.0

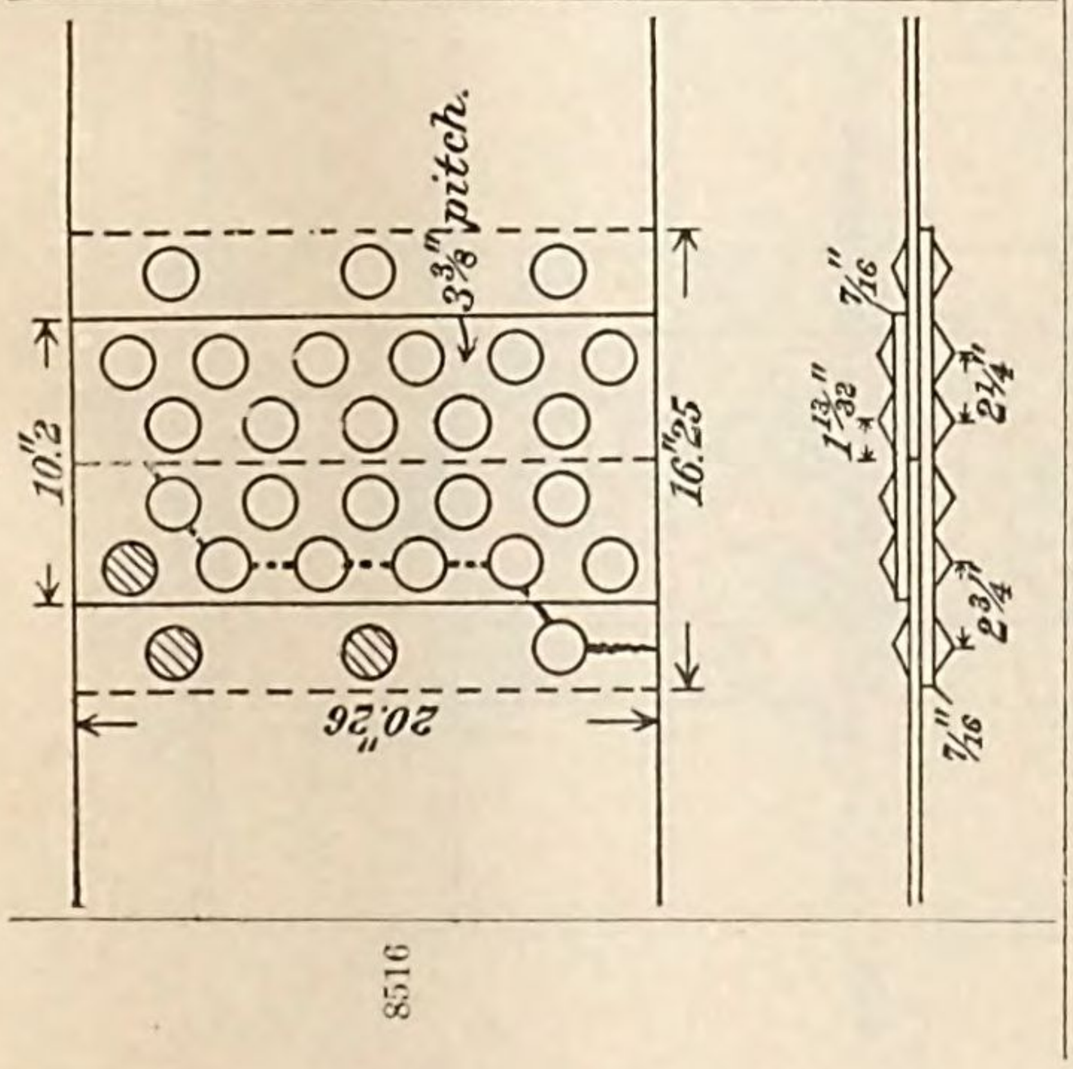
8506	13.515	10″	15.″5	1 13/32″	2¼″	2¾″	3 3/8″ pitch.	½	do	80.3	29,640	77,900	62,200
									do	83.5	22, 480	59, 950	62,200
8507	10″005	10″	15¾″	1 13/32″	2¼″	2¾″	2½″ pitch.	½	do	80.3	29,640	77,900	56,410
									do	83.5	22, 480	59, 950	56,410

8506	13.515	10″	15.″5	1 13/32″	2¼″	2¾″	3 3/8″ pitch.	½	do	80.3	60,550	11.04	4.20	5.80	.73	48,620	60,550
									do	83.5	50, 550	11. 04	4. 14	3. 99	.91	48,620	60,550
8507	10″005	10″	15¾″	1 13/32″	2¼″	2¾″	2½″ pitch.	½	do	80.3	60,550	11.04	4.20	5.80	.73	48,620	60,550
									do	83.5	50, 550	11. 04	4. 14	3. 99	.91	48,620	60,550

TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

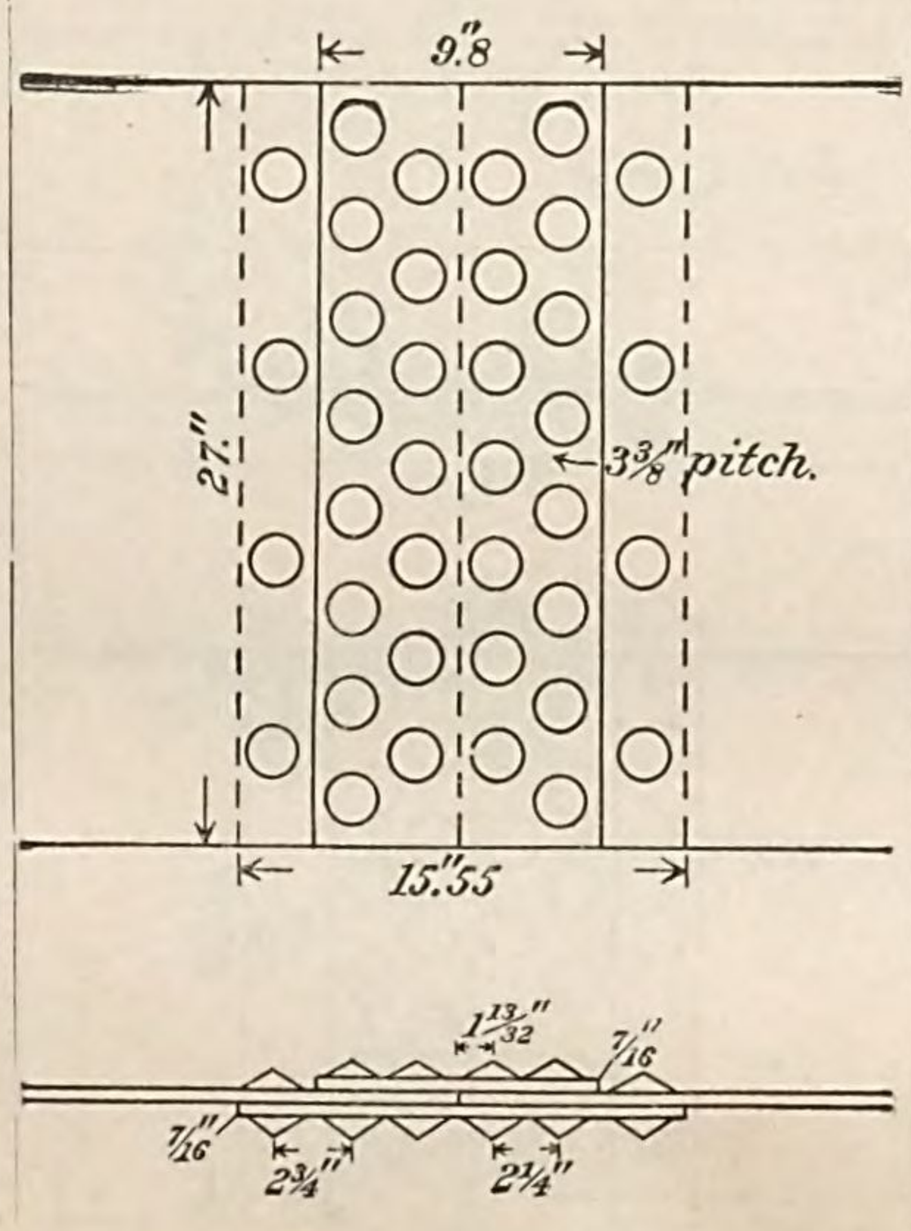
No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
8515		½	⅞″ steel rivets, 15/16″ drilled holes.	7.05	5.73	6.17	17.25	59,890	51,205	**63,000**	58,510	20,930	85.5

									85.3	
								29,410		
							78,900			
						59,330				
					51,088					
				59,890						
			17.25							
		6.43								
	8.55									
9.93										
½	do	do	do	do	do	do	do	do	do	do

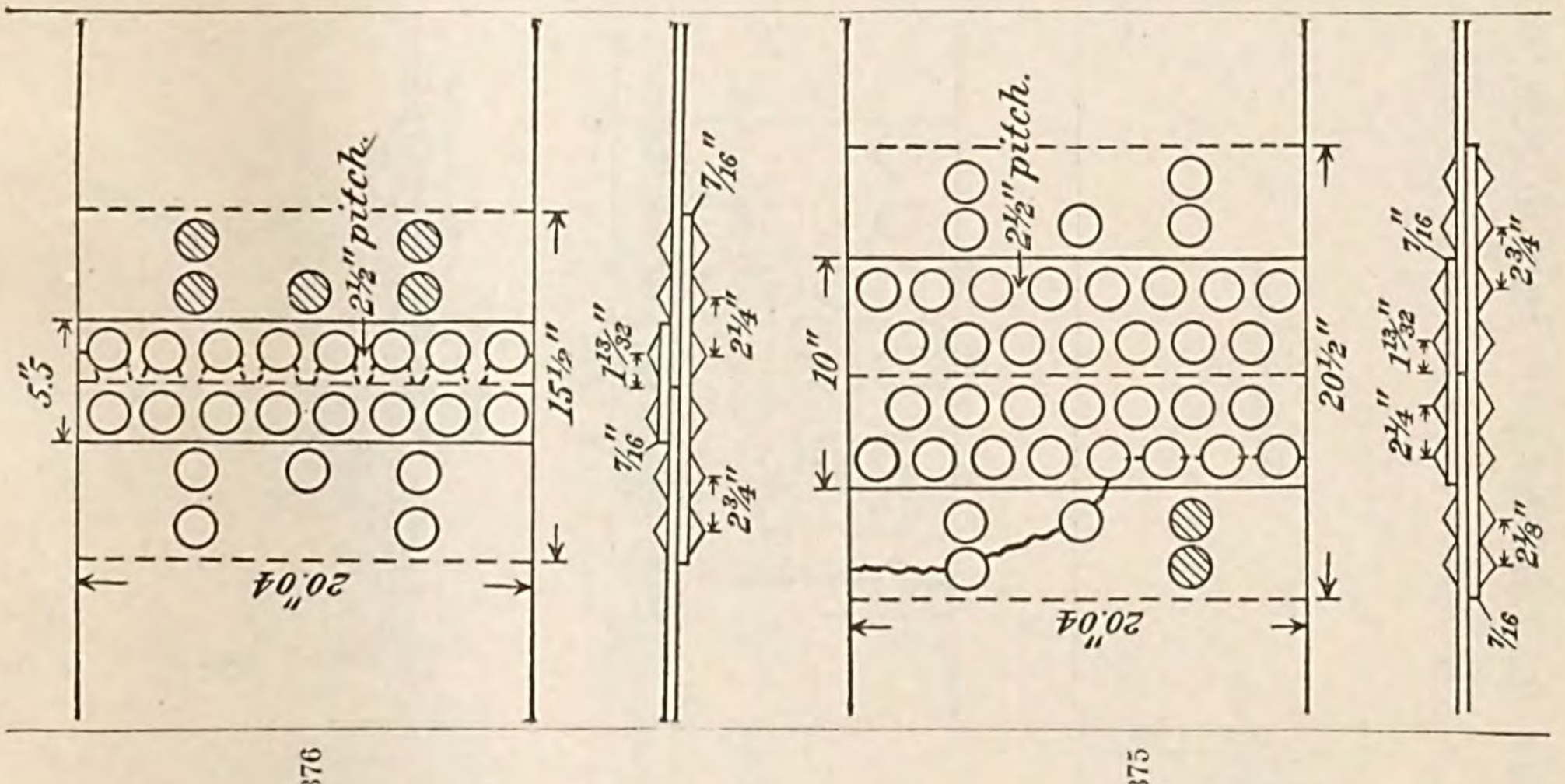


8516

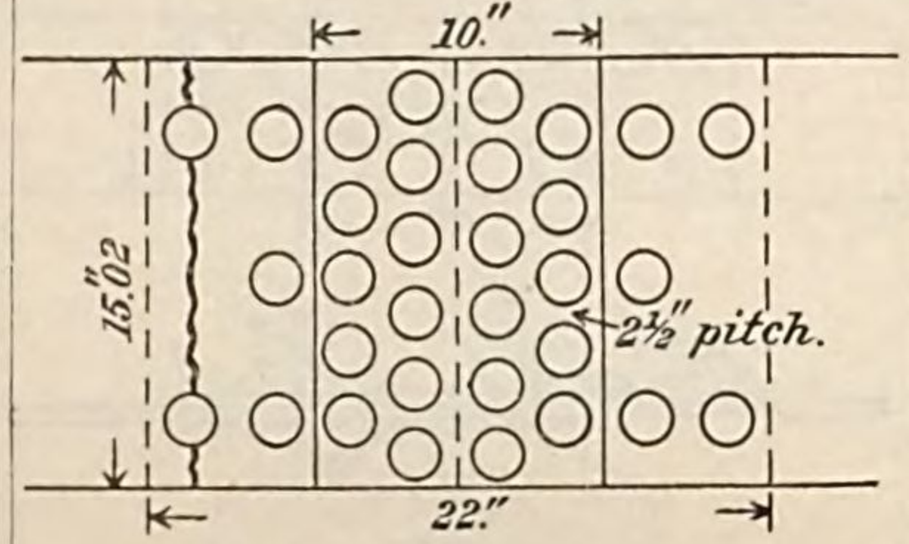
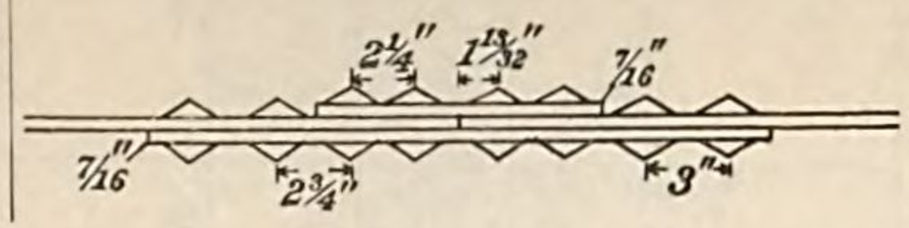
TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
9436		½	⅞″ steel rivets, 15/16″ drilled holes.	14.77	12.72	9.74	23.46	59,680	47,407	55,050	71,890	29,850	79.4

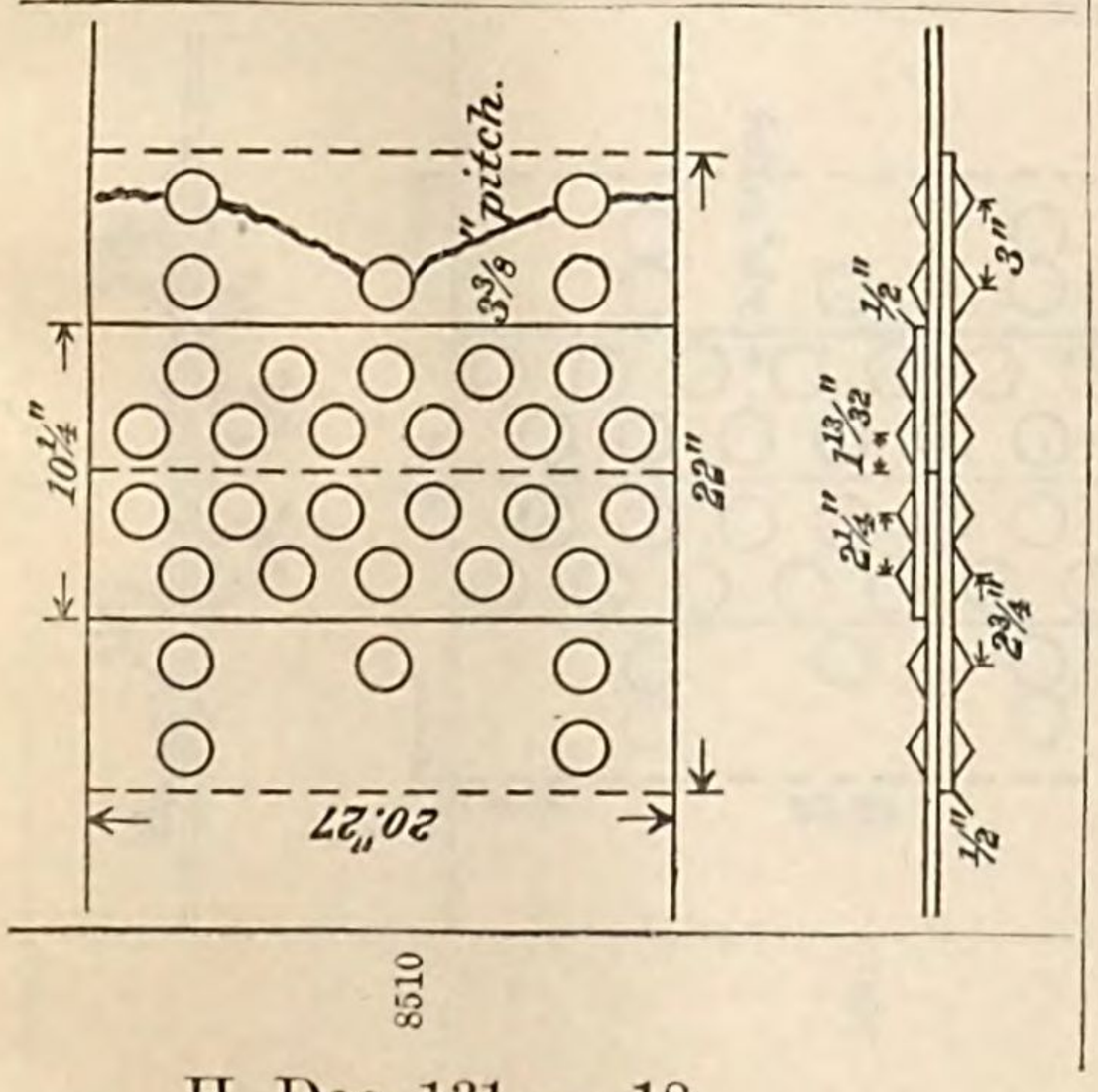
9375	½	....do....	11	51,340	76,550	36,030	78.0	6.82	14.49	59,680	46,530
9376	½	....do....	10	52,150	50,170	20,790	78.6	10.01	24.15	59,680	46,930



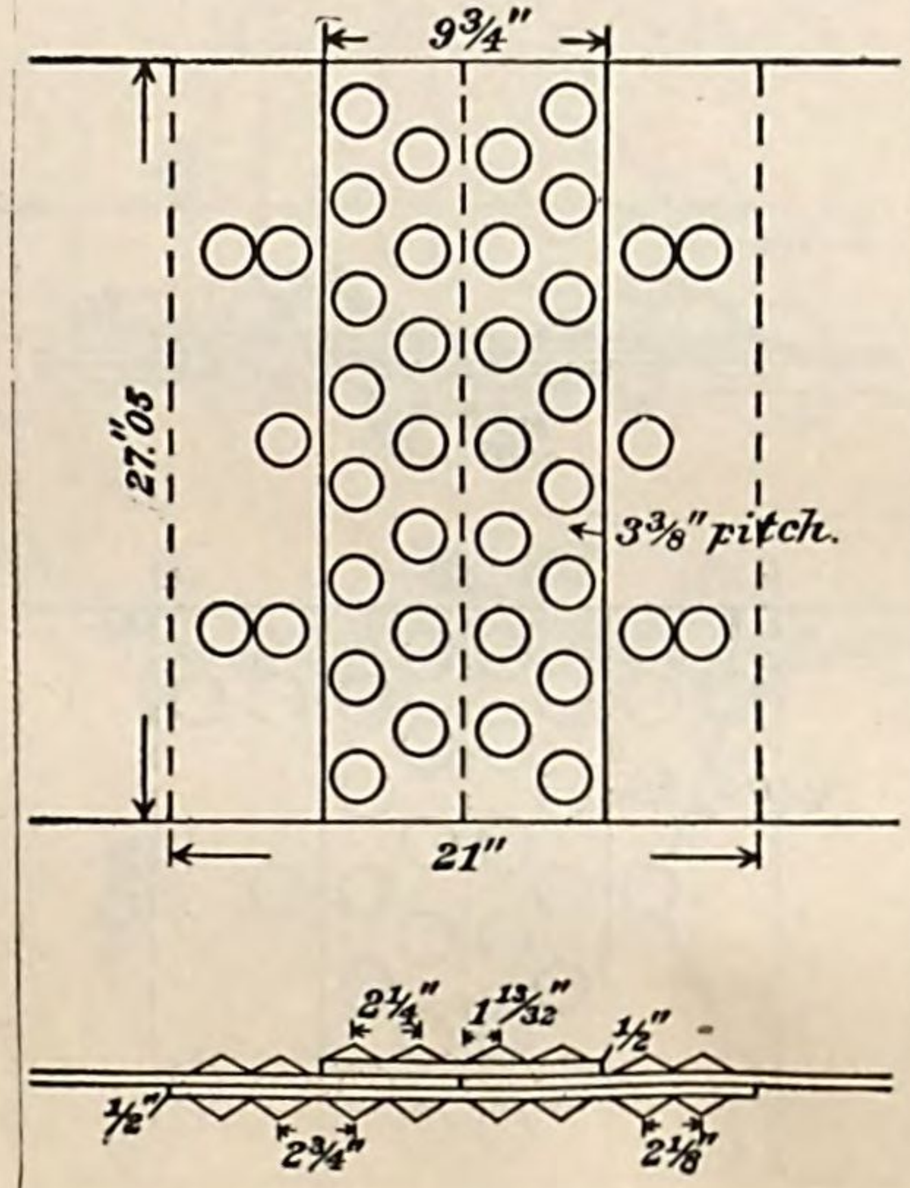
TABULATION OF RIVITED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
8508		½	⅞″ steel rivets, 15/16″ drilled holes.	7.35	6.43	7.34	18.63	60,550	54,580	**62,390**	54,660	21,530	90.1
8509		½	.....do	7.49	6.56	7.48	18.63	60,550	51,282	**58,550**	51,350	20,620	84.7

											82.5
											27,030
											67,490
											55,030
											49,960
											60,550
											18.63
											7.46
											9.15
											10.08
											½ .....do.....



TABULATION OF RIVETED JOINTS, CONTRIBUTED BY EDWARD KENDALL & SONS, CAMBRIDGEPORT, MASS.—Continued.

No. of test.	Style of joint.	Nominal thickness of plate.	Size and kind of rivets and holes.	Sectional area of plate.		Bearing surface of rivets.	Shearing area of rivets.	Tensile strength of plate per square inch.	Maximum stress on joint per square inch.				Efficiency of joint.
				Gross.	Net.				Tension on gross section of plate.	Tension on net section of plate.	Compression on bearing surface of rivets.	Shearing on rivets.	
		Inch.		*Sq. in.*	*Sq. in.*	*Sq. in.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
9437		½	⅞" steel rivets, 15/16" drilled holes.	15.08	13.88	10.45	24.15	59,060	42,440	46,110	61,240	26,500	71.1

Joint No. 8508 tested hot. Temperature about 410° F.

Joints Nos. 9436 and 9437 were not fractured. Stresses computed and efficiencies given for the maximum loads which were reached.

Figures in heavy-faced type denote the manner of failure.

RIVETED AND BOLTED JOINTS.

RIVETED AND BOLTED JOINTS.

These plates were designed and prepared by the Berlin Iron Bridge Company, of East Berlin, Conn., who contributed the material for testing.

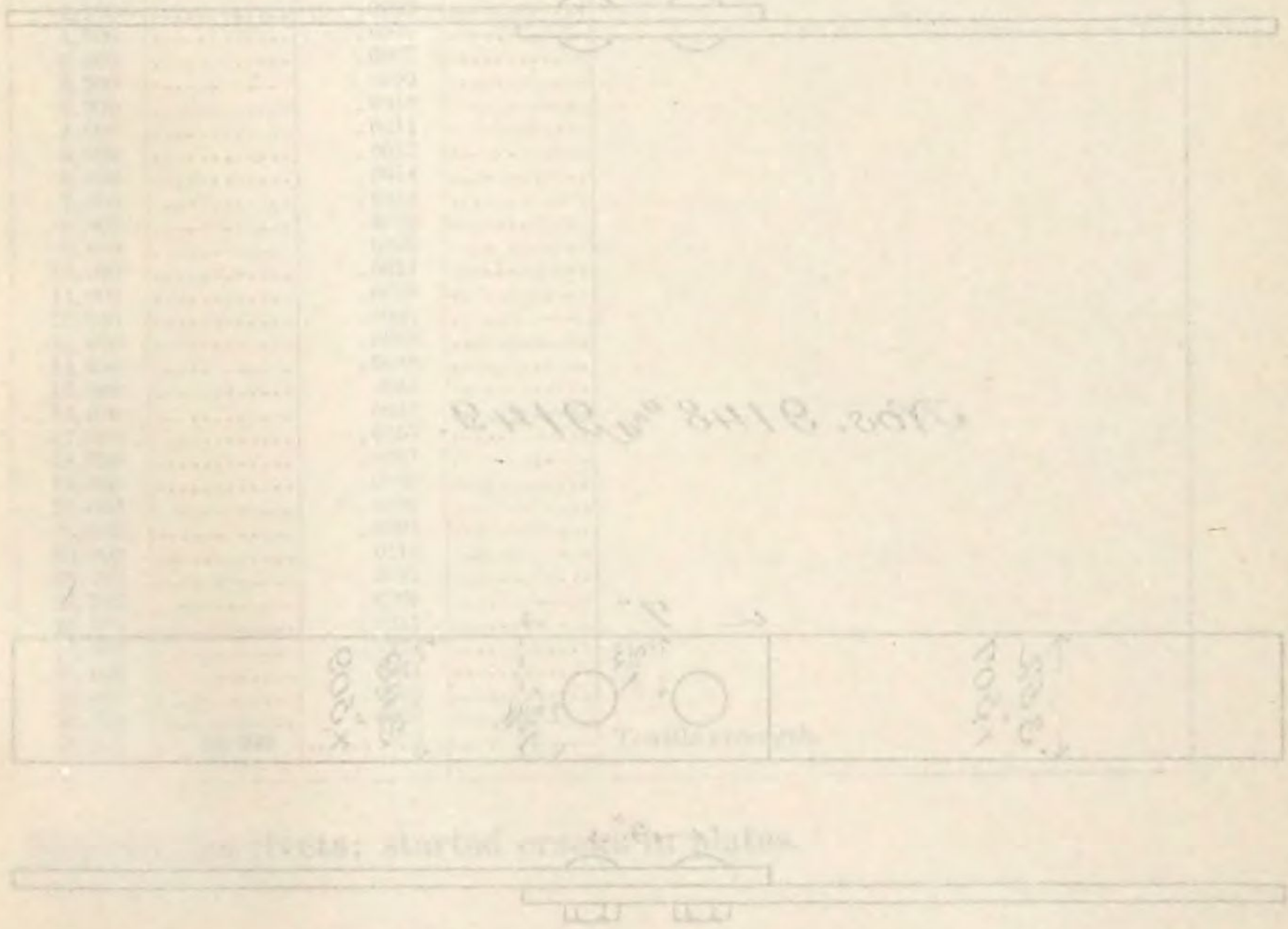
No. 6146.

Marks, S. I.

Original thickness, plate, 0.25 in.; rivets, 0.75 in. diameter.

Cross-sectional area of plate, 2 × 6.25 × 0.25 = 3.125 square inches.

Original length, 6".



No. 9147.

Marks, B 2.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of plate, $3''.50 \times ''.509 = 1.781$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
1,500	.....	.0001	.....	
2,000	.....	.0003	.....	
2,500	.....	.0005	.....	
3,000	.....	.0007	.....	
4,000	.....	.0009	.....	
5,000	.....	.0012	.....	
6,000	.....	.0016	.....	
7,000	.....	.0020	.....	
8,000	.....	.0023	.....	
9,000	.....	.0026	.....	
10,000	.....	.0028	.....	
11,000	.....	.0029	.....	
12,000	.....	.0032	.....	
13,000	.....	.0038	.....	
14,000	.....	.0040	.....	
15,000	.....	.0042	.....	
16,000	.....	.0047	.....	
17 000	.....	.0049	.....	
18,000	.....	.0052	.....	
19,000	.....	.0059	.....	
20,000	.....	.0061	.....	
21,000	.....	.0068	.....	
22,000	.....	.0072	.....	
23,000	.....	.0078	.....	
24,000	.....	.0085	.....	
25,000	.....	.0095	.....	
26,000	.....	.0107	.....	
27,000	.....	.0128	.....	
28,000	.....	.0182	.....	
29,000	.....	.0200	.....	
30,000	.....	.0217	.....	
32,000	.....	.0251	.....	
34,000	.....	.0710	.....	
46,520	26,120	.....	.....	Tensile strength.

Sheared the rivets; started cracks in plates.

No. 9148.

Marks, B 3.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of plate, 3''.52 × ''.507 ..... square inches.. 1.785
Shearing area of bolts, ''.73 diameter ..... do .... .837

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0002	.....	
1,500	.....	.0006	.....	
2,000	.....	.0011	.....	
2,500	.....	.0015	.....	
3,000	.....	.0019	.....	
4,000	.....	.0069	.....	
5,000	.....	.0135	.....	
6,000	.....	.0220	.....	
7,000	.....	.0319	.....	
8,000	.....	.0518	.....	
9,000	.....	.0590	.....	
10,000	.....	.1150	.....	
37,690	{ 21,110	.....	.....	Tensile strength; sheared the bolts.
	{ 45,030	.....	.....	Shearing strength of bolts.

No. 9149.

Marks, B 4.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of plate 3''.49 × ''.509 ..... square inches.. 1.776
Shearing area of bolts ''.73 diameter ..... do .... .837

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0009	.....	
1,500	.....	.0048	.....	
2,000	.....	.0120	.....	
2,500	.....	.0182	.....	
3,000	.....	.0240	.....	
4,000	.....	.0750	.....	
5,000	.....	.0820	.....	
6,000	.....	.0925	.....	
7,000	.....	.1005	.....	
8,000	.....	.1091	.....	
9,000	.....	.1142	.....	
10,000	.....	.1209	.....	
33,200	{ 18,690	.....	.....	Tensile strength; sheared the bolts.
	{ 39,660	.....	.....	Shearing strength of bolts.

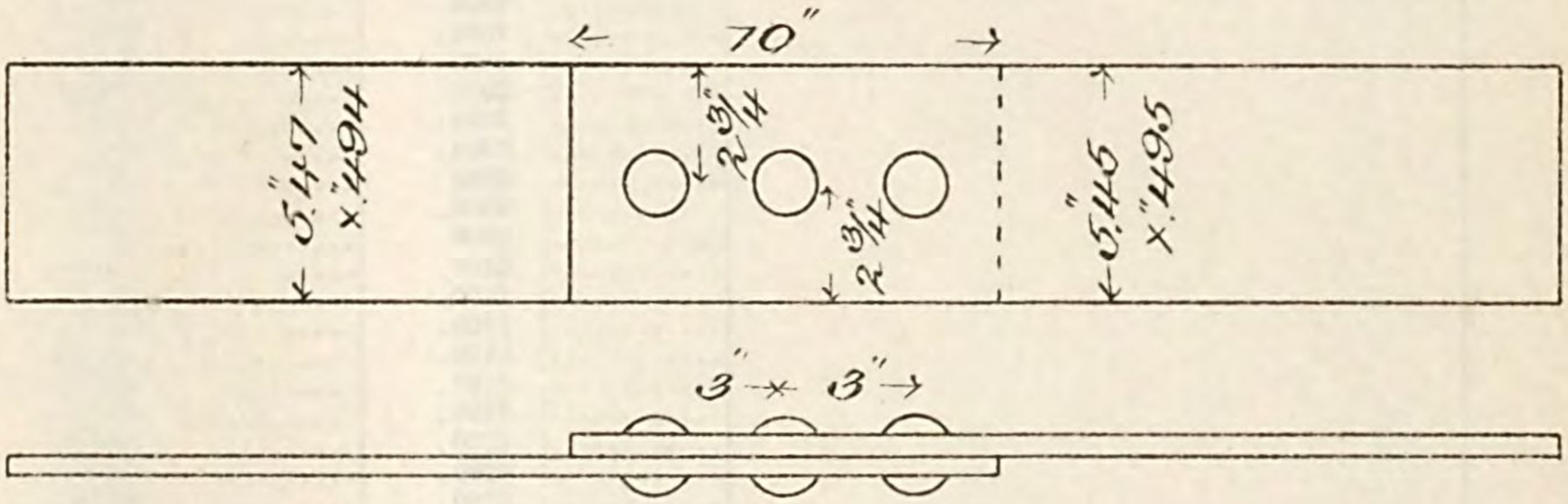
No. 9150.

Marks, B 9.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ steel rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of plate, $5''.47 \times ''.494 = 2.702$ square inches.
Gauged length, $6''$.

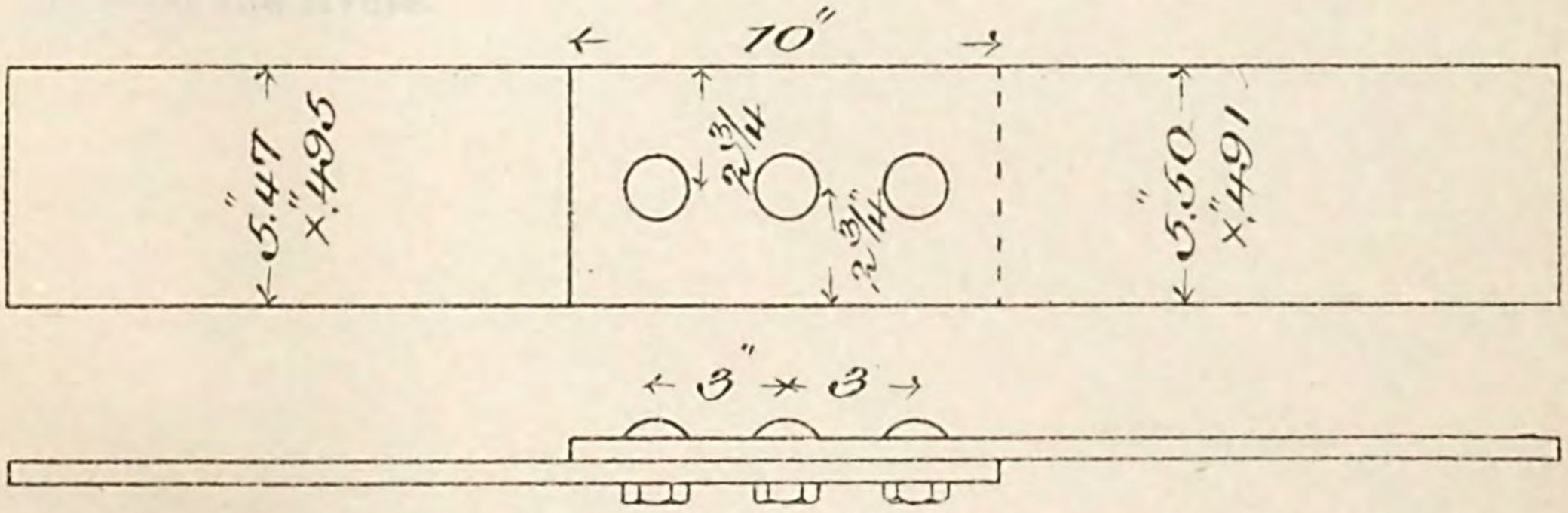
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
1,500	.....	.0000	.....	
2,000	.....	.0001	.....	
2,500	.....	.0001	.....	
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0002	.....	
6,000	.....	.0005	.....	
7,000	.....	.0007	.....	
8,000	.....	.0009	.....	
9,000	.....	.0010	.....	
10,000	.....	.0012	.....	
11,000	.....	.0014	.....	
12,000	.....	.0016	.....	
13,000	.....	.0018	.....	
14,000	.....	.0021	.....	
16,000	.....	.0024	.....	
18,000	.....	.0030	.....	
20,000	.....	.0034	.....	
22,000	.....	.0040	.....	
24,000	.....	.0047	.....	
26,000	.....	.0055	.....	
28,000	.....	.0061	.....	
30,000	.....	.0077	.....	
32,000	.....	.0092	.....	
34,000	.....	.0121	.....	
36,000	.....	.0160	.....	
38,000	.....	.0178	.....	
40,000	.....	.0190	.....	
42,000	.....	.0200	.....	
44,000	.....	.0212	.....	
46,000	.....	.0241	.....	
48,000	.....	.0275	.....	
50,000	.....	.0480	.....	
79,960	29,590	.....	.....	Tensile strength.

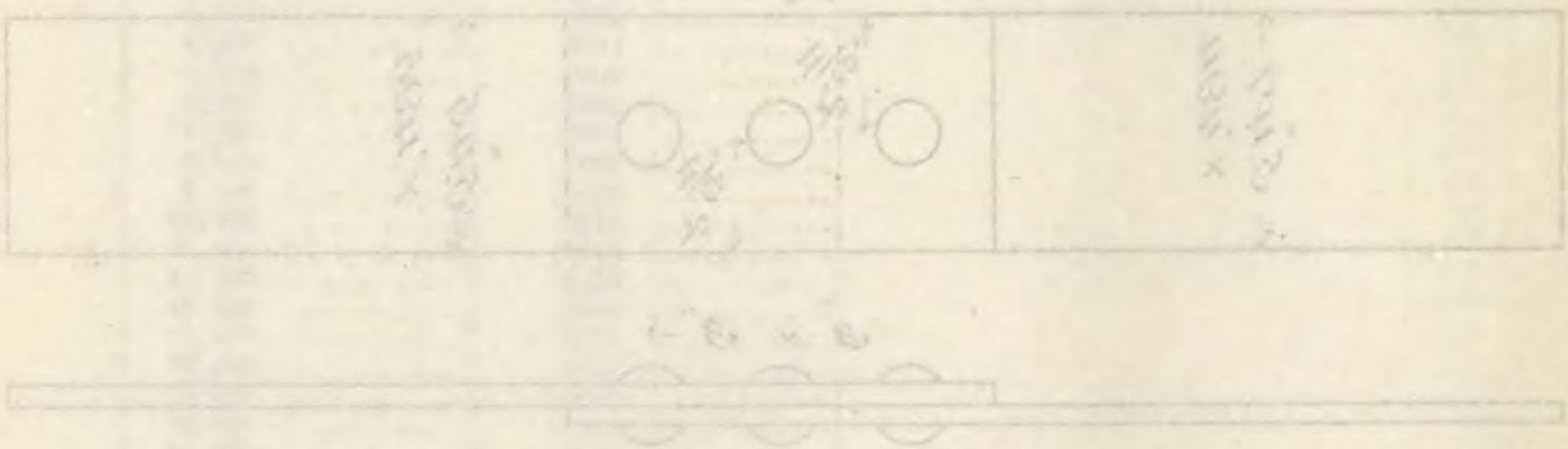
Sheared the rivets.

Nos. 9150 and 9151.



Nos. 9152 and 9153.





No. 9151.

Marks, B 10.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of plate, $5''.45 \times ''.495 = 2.698$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
1,500	.....	.0000	.....	
2,000	.....	.0001	.....	
2,500	.....	.0001	.....	
3,000	.....	.0002	.....	
4,000	.....	.0003	.....	
5,000	.....	.0005	.....	
6,000	.....	.0006	.....	
7,000	.....	.0008	.....	
8,000	.....	.0009	.....	
9,000	.....	.0010	.....	
10,000	.....	.0011	.....	
11,000	.....	.0011	.....	
12,000	.....	.0013	.....	
13,000	.....	.0015	.....	
14,000	.....	.0017	.....	
16,000	.....	.0021	.....	
18,000	.....	.0023	.....	
20,000	.....	.0027	.....	
22,000	.....	.0030	.....	
24,000	.....	.0035	.....	
26,000	.....	.0040	.....	
28,000	.....	.0045	.....	
30,000	.....	.0052	.....	
32,000	.....	.0060	.....	
34,000	.....	.0071	.....	
36,000	.....	.0085	.....	
38,000	.....	.0110	.....	
40,000	.....	.0160	.....	
42,000	.....	.0171	.....	
44,000	.....	.0188	.....	
46,000	.....	.0200	.....	
48,000	.....	.0440	.....	
65,600	24,310	.....	.....	Tensile strength.

Sheared the rivets.

No. 9152.

Marks, B 11.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die, $\frac{7}{8}''$ diameter.

Gross sectional area of plate, $5''.47 \times ''.495$ ..... square inches.. 2.708
Shearing area of bolts, $''.73$ diameter ..... do.... 1.255

Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0003	.....	
2,000	.....	.0004	.....	
2,500	.....	.0008	.....	
3,000	.....	.0040	.....	
4,000	.....	.0065	.....	
5,000	.....	.0140	.....	
6,000	.....	.0240	.....	
7,000	.....	.0330	.....	
8,000	.....	.0468	.....	
9,000	.....	.0678	.....	
10,000	.....	.0842	.....	
11,000	.....	.0915	.....	
12,000	.....	.0970	.....	
13,000	.....	.1021	.....	
14,000	.....	.1075	.....	
16,000	.....	.1169	.....	
18,000	.....	.1250	.....	
20,000	.....	.1328	.....	
58,120	21,460	.....	.....	Tensile strength.
	46,310	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9153.

Marks, B 12.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of plate, $5''.50 \times ''.491$ ..... square inches.. 2.700
Shearing area of bolts, $''.73$ diameter ..... do.... 1.255

Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
1,500	.....	.0001	.....	
2,000	.....	.0003	.....	
2,500	.....	.0007	.....	
3,000	.....	.0010	.....	
4,000	.....	.0018	.....	
5,000	.....	.0041	.....	
6,000	.....	.0068	.....	
7,000	.....	.0100	.....	
8,000	.....	.0142	.....	
9,000	.....	.0191	.....	
10,000	.....	.0249	.....	
11,000	.....	.0319	.....	
12,000	.....	.0390	.....	
13,000	.....	.0461	.....	
14,000	.....	.0515	.....	
16,000	.....	.0644	.....	
18,000	.....	.0775	.....	
20,000	.....	.0880	.....	
22,000	.....	.0988	.....	
24,000	.....	.1080	.....	
26,000	.....	.1241	.....	
48,850	18,090	.....	.....	Tensile strength.
	38,920	.....	.....	Shearing strength of bolts.

Sheared the bolts.

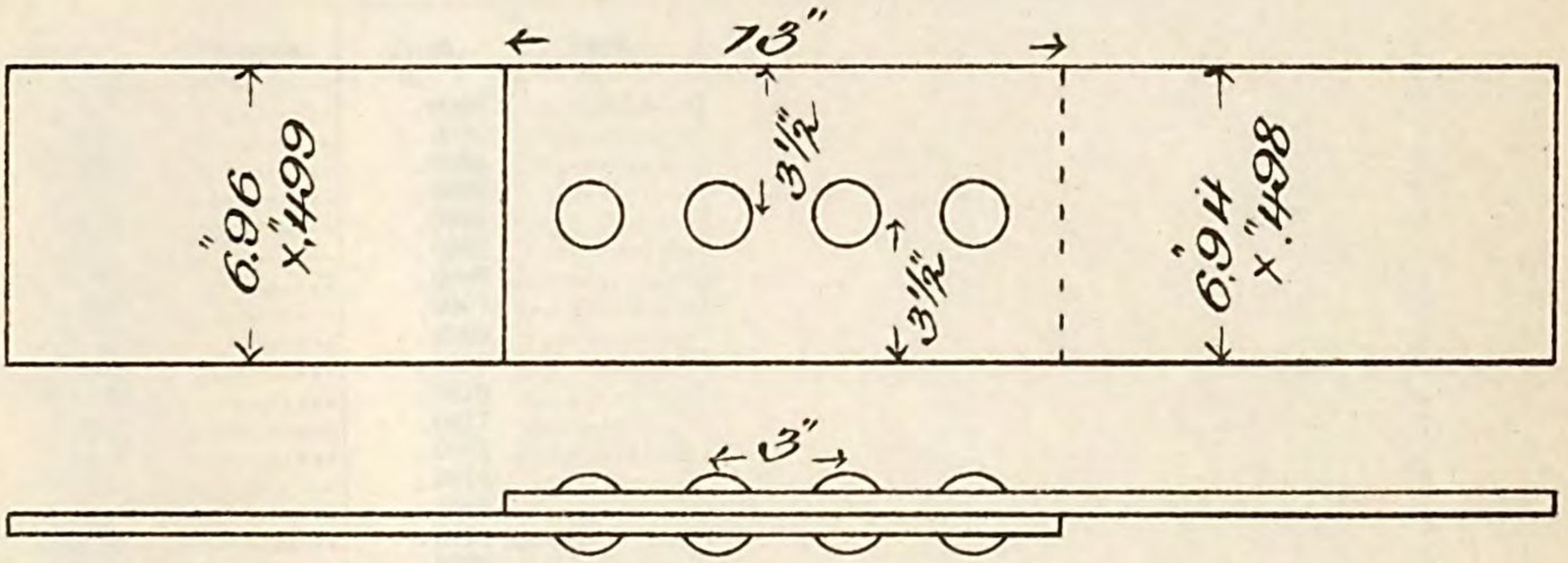
No. 9154.

Marks, B 17.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ steel rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of plate, $6''.96 \times ''.499 = 3.473$ square inches.
Gauged length, $6''$.

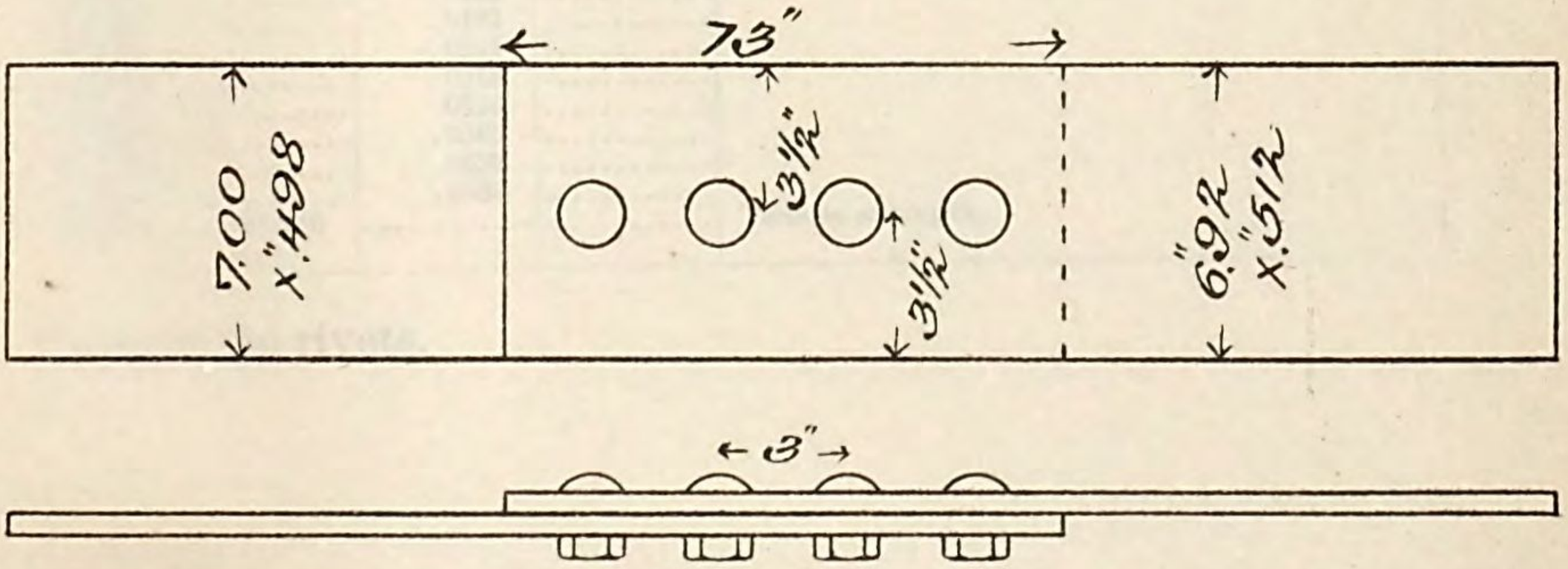
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0002	.....	
6,000	.....	.0003	.....	
7,000	.....	.0004	.....	
8,000	.....	.0007	.....	
9,000	.....	.0010	.....	
10,000	.....	.0012	.....	
11,000	.....	.0013	.....	
12,000	.....	.0016	.....	
13,000	.....	.0018	.....	
14,000	.....	.0020	.....	
15,000	.....	.0021	.....	
16,000	.....	.0023	.....	
18,000	.....	.0030	.....	
20,000	.....	.0034	.....	
22,000	.....	.0041	.....	
24,000	.....	.0049	.....	
26,000	.....	.0056	.....	
28,000	.....	.0064	.....	
30,000	.....	.0074	.....	
32,000	.....	.0088	.....	
34,000	.....	.0110	.....	
36,000	.....	.0134	.....	
38,000	.....	.0160	.....	
40,000	.....	.0172	.....	
42,000	.....	.0188	.....	
44,000	.....	.0200	.....	
46,000	.....	.0204	.....	
48,000	.....	.0212	.....	
50,000	.....	.0221	.....	
52,000	.....	.0231	.....	
54,000	.....	.0241	.....	
56,000	.....	.0252	.....	
58,000	.....	.0262	.....	
60,000	.....	.0310	.....	
		.0450	.....	
62,000	.....	.0495	.....	
64,000	.....	.0550	.....	
66,000	.....	.0610	.....	
100,100	28,820	.....	.....	Tensile strength.

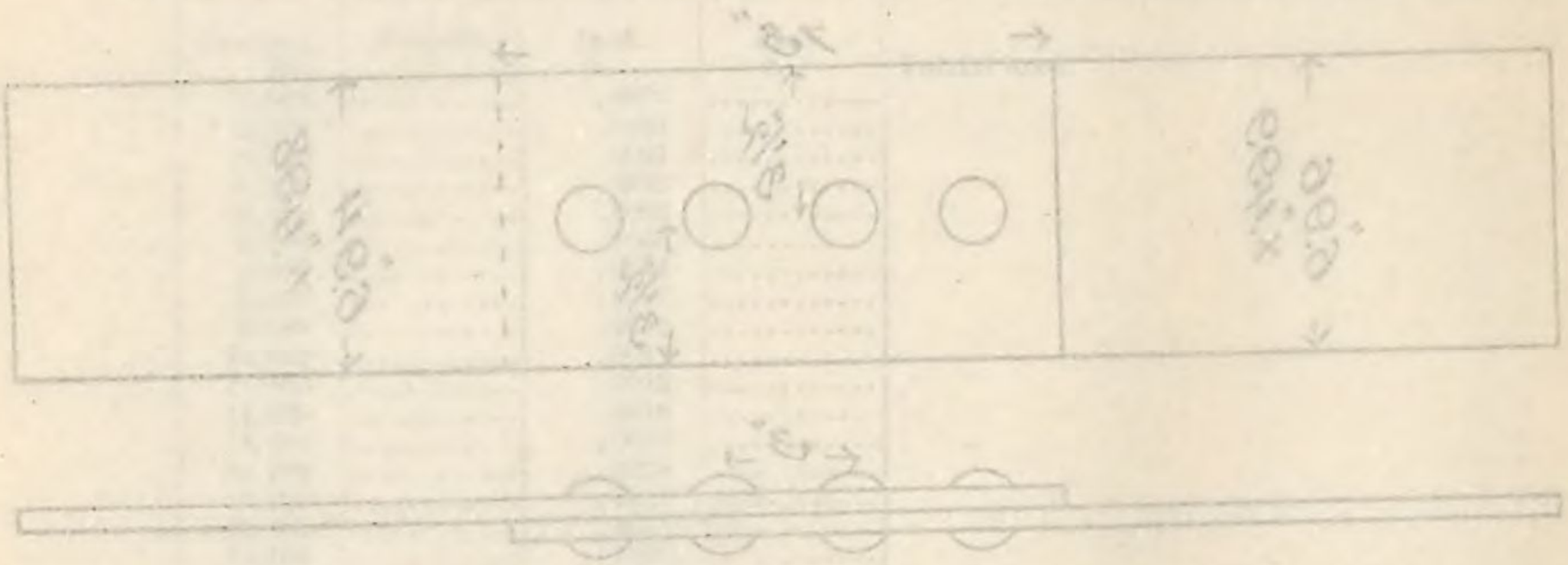
Sheared the rivets.

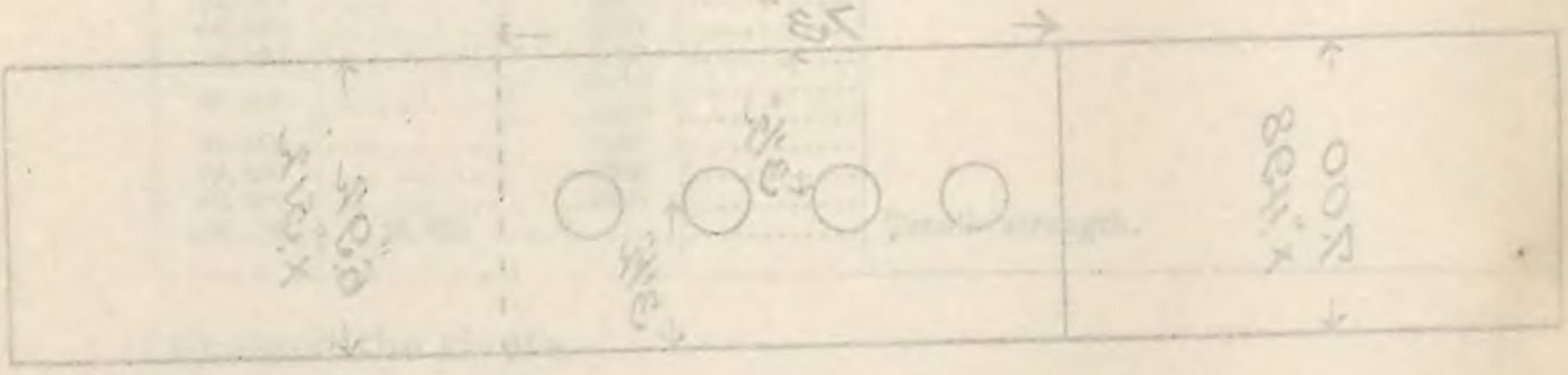
Nos. 9154 and 9155.



Nos. 9156 and 9157.







No. 9155.

Marks, B 18.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}$, die $\frac{7}{8}''$ diameter.
Gross sectional area of plate, $6''.94 \times ''.498 = 3.456$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0003	.....	
6,000	.....	.0004	.....	
7,000	.....	.0006	.....	
8,000	.....	.0007	.....	
9,000	.....	.0009	.....	
10,000	.....	.0010	.....	
11,000	.....	.0010	.....	
12,000	.....	.0011	.....	
13,000	.....	.0012	.....	
14,000	.....	.0014	.....	
15,000	.....	.0016	.....	
16,000	.....	.0018	.....	
18,000	.....	.0020	.....	
20,000	.....	.0022	.....	
22,000	.....	.0026	.....	
24,000	.....	.0030	.....	
26,000	.....	.0032	.....	
28,000	.....	.0037	.....	
30,000	.....	.0040	.....	
32,000	.....	.0044	.....	
34,000	.....	.0048	.....	
36,000	.....	.0054	.....	
38,900	.....	.0062	.....	
40,000	.....	.0068	.....	
42,000	.....	.0075	.....	
44,000	.....	.0085	.....	
46,000	.....	.0098	.....	
48,000	.....	.0125	.....	
50,000	.....	.0172	.....	
52,000	.....	.0182	.....	
54,000	.....	.0192	.....	
56,000	.....	.0201	.....	
58,000	.....	.0218	.....	
60,000	.....	.0530	.....	
62,000	.....	.0580	.....	
64,000	.....	.0629	.....	
66,000	.....	.0688	.....	
91,400	26,450	.....	.....	Tensile strength.

Sheared the rivets.

No. 9156.

Marks, B 19.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of plate, $7'' \times ''.498$.....square inches.. 3.486
Shearing area of bolts, $''.73$ diameter.....do.... 1.674

Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0006	.....	
4,000	.....	.0008	.....	
5,000	.....	.0016	.....	
6,000	.....	.0033	.....	
7,000	.....	.0065	.....	
8,000	.....	.0116	.....	
9,000	.....	.0580	.....	
10,000	.....	.0660	.....	
11,000	.....	.0760	.....	
12,000	.....	.0851	.....	
13,000	.....	.0902	.....	
14,000	.....	.0951	.....	
15,000	.....	.0990	.....	
16,000	.....	.1022	.....	
18,000	.....	.1153	.....	
20,000	.....	.1261	.....	
22,000	.....	.1353	.....	
24,000	.....	.1413	.....	
76,900	22,060	.....	.....	Tensile strength.
	45,940	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9157.

Marks, B 20.
$\frac{1}{2}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of plate, 6''.92 × ''.512 ..... square inches.. 3.543
Shearing area of bolts, ''.73 diameter ..... do.... 1.674

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0003	.....	
4,000	.....	.0008	.....	
5,000	.....	.0032	.....	
6,000	.....	.0073	.....	
7,000	.....	.0290	.....	
8,000	.....	.0470	.....	
9,000	.....	.0600	.....	
10,000	.....	.0650	.....	
11,000	.....	.0738	.....	
12,000	.....	.0835	.....	
13.000	.....	.0880	.....	
14,000	.....	.0935	.....	
15,000	.....	.0979	.....	
16,000	.....	.1000	.....	
18,000	.....	.1070	.....	
20,000	.....	.1112	.....	
22,000	.....	.1173	.....	
24,000	.....	.1238	.....	
26,000	.....	.1290	.....	
28,000	.....	.1355	.....	
30,000	.....	.1418	.....	
72,510	20,470	.....	.....	Tensile strength.
	43,310	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9158.

Marks, B 5.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, $4''.08 \times ''.745$ ..... square inches.. 3.040
Net sectional area of web plate, $2''.39 \times ''.745$ ..... do.... 1.780

Gauged length, $6''$.

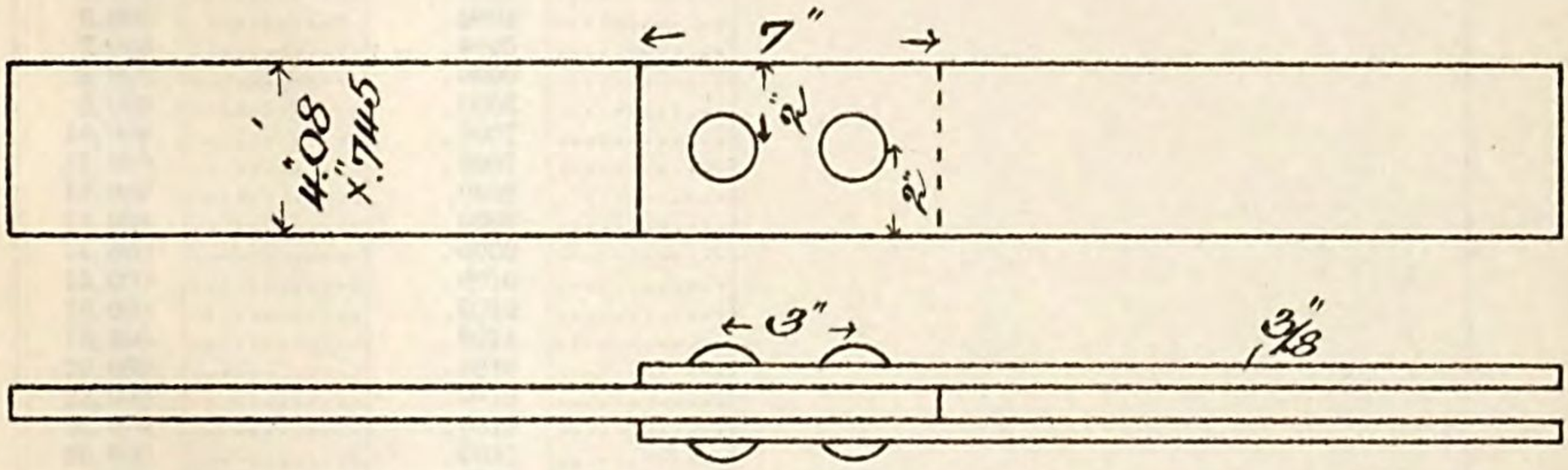
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0003	.....	
6,000	.....	.0004	.....	
7,000	.....	.0005	.....	
8,000	.....	.0006	.....	
9,000	.....	.0008	.....	
10.000	.....	.0009	.....	
11,000	.....	.0010	.....	
12,000	.....	.0010	.....	
13,000	.....	.0011	.....	
14,000	.....	.0011	.....	
15,000	.....	.0012	.....	
16,000	.....	.0012	.....	
18,000	.....	.0015	.....	
20,000	.....	.0017	.....	
22,000	.....	.0020	.....	
24,000	.....	.0021	.....	
26,000	.....	.0024	.....	
28,000	.....	.0026	.....	
30,000	.....	.0028	.....	
32,000	.....	.0032	.....	
34,000	.....	.0045	.....	
36,000	.....	.0061	.....	
38,000	.....	.0070	.....	
40,000	.....	.0079	.....	
42,000	.....	.0086	.....	
44,000	.....	.0091	.....	
46,000	.....	.0098	.....	
48,000	.....	.0102	.....	
50,000	.....	.0111	.....	
52,000	.....	.0120	.....	
54,000	.....	.0129	.....	
56,000	.....	.0143	.....	
58,000	.....	.0228	.....	
60,000	.....	.0412	.....	
62,000	.....	.0445	.....	
64,000	.....	.0493	.....	
66,000	.....	.0530	.....	
68,000	.....	.0580	.....	
70,000	.....	.0621	.....	
89,800	29,540	.....	.....	Tensile strength.

Fractured web plate.
Granular.

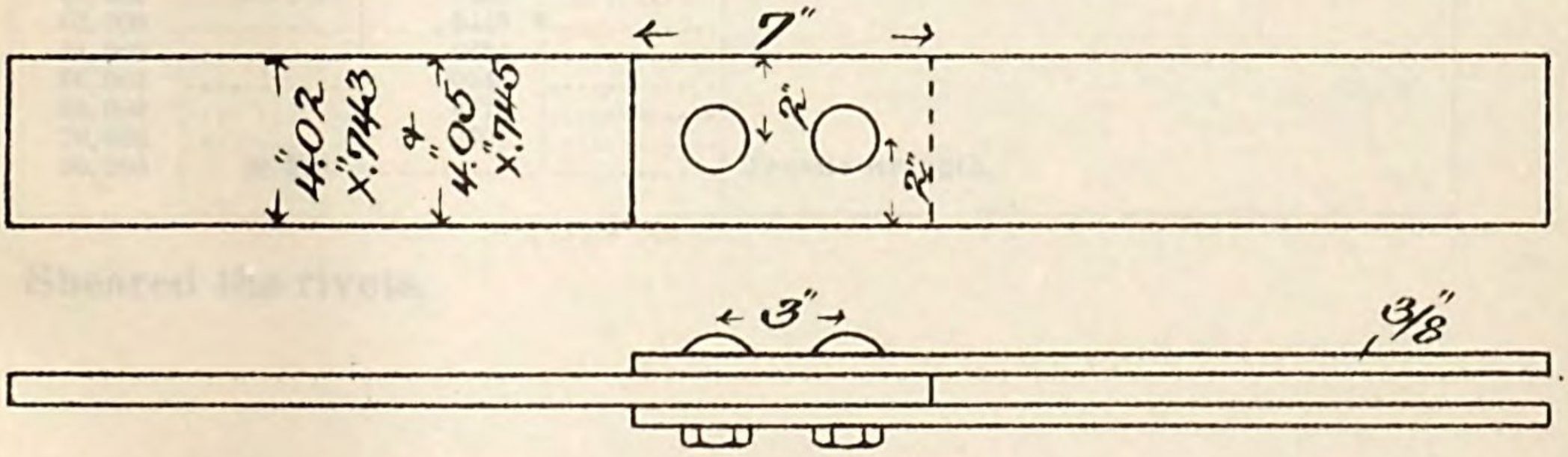
Maximum stress on joint.

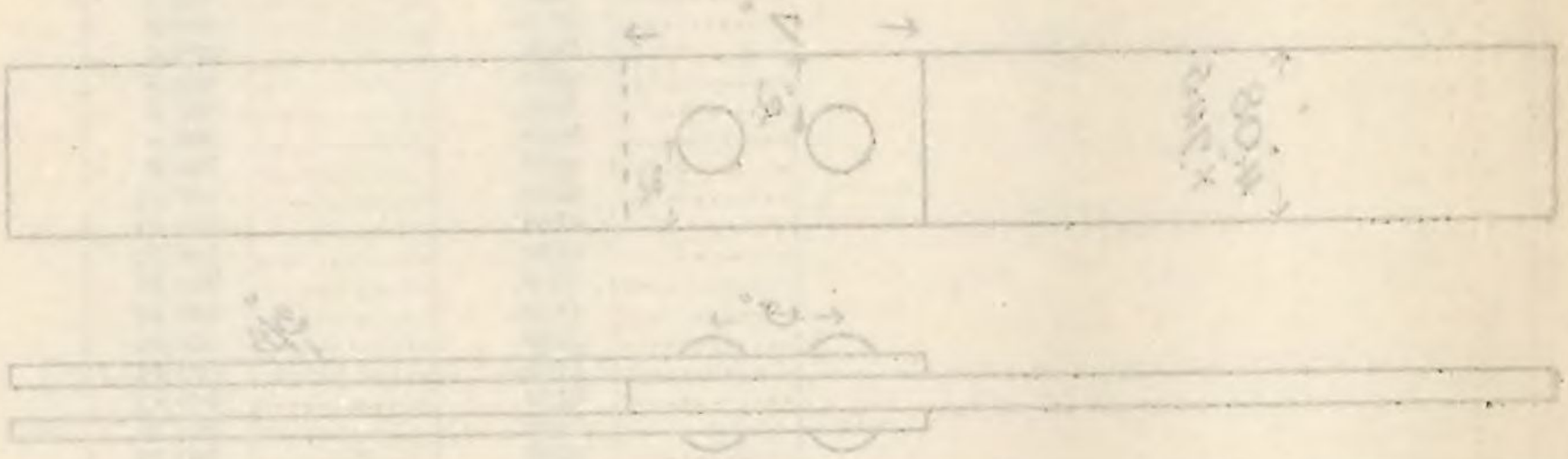
Tension on gross section of plate ..... pounds per square inch.. 29,540
Tension on net section of plate ..... do.... 50,450

Nos. 9158 and 9159.



Nos. 9160 and 9161.





No. 9159.

Marks, B 6.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of web plate, $4''.08 \times ''.745 = 3.040$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0002	.....	
4,000	.....	.0003	.....	
5,000	.....	.0004	.....	
6,000	.....	.0004	.....	
7,000	.....	.0005	.....	
8,000	.....	.0006	.....	
9,000	.....	.0006	.....	
10,000	.....	.0007	.....	
11,000	.....	.0007	.....	
12,000	.....	.0008	.....	
13,000	.....	.0008	.....	
14,000	.....	.0009	.....	
15,000	.....	.0010	.....	
16,000	.....	.0012	.....	
18,000	.....	.0014	.....	
20,000	.....	.0016	.....	
22,000	.....	.0018	.....	
24,000	.....	.0019	.....	
26,000	.....	.0021	.....	
28,000	.....	.0024	.....	
30,000	.....	.0027	.....	
32,000	.....	.0036	.....	
34,000	.....	.0050	.....	
36,000	.....	.0060	.....	
38,000	.....	.0069	.....	
40,000	.....	.0076	.....	
42,000	.....	.0084	.....	
44,000	.....	.0088	.....	
46,000	.....	.0093	.....	
48,000	.....	.0098	.....	
50,000	.....	.0107	.....	
52,000	.....	.0119	.....	
54,000	.....	.0138	.....	
56,000	.....	.0161	.....	
58,000	.....	.0229	.....	
60,000	.....	.0420	.....	
62,000	.....	.0446	.....	
64,000	.....	.0494	.....	
66,000	.....	.0543	.....	
68,000	.....	.0576	.....	
70,000	.....	.0631	.....	
90,200	29,670	.....	.....	Tensile strength.

Sheared the rivets.

No. 9160.

Marks, B 7.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, $4''.02 \times ''.743$.....square inches.. 2.987
Shearing area of bolts, ''.73 diameter.....do..... 1.674

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0011	.....	
3,000	.....	.0700	.....	
4,000	.....	.0739	.....	
5,000	.....	.0855	.....	
6,000	.....	.1030	.....	
7,000	.....	.1170	.....	
8,000	.....	.1212	.....	
9,000	.....	.1280	.....	
10,000	.....	.1322	.....	
11,000	.....	.1371	.....	
12,000	.....	.1412	.....	
13,000	.....	.1452	.....	
14,000	.....	.1500	.....	
15,000	.....	.1550	.....	
16,000	.....	.1610	.....	
18,000	.....	.1699	.....	
20,000	.....	.1765	.....	
22,000	.....	.1823	.....	
24,000	.....	.1880	.....	
26,000	.....	.1940	.....	
28,000	.....	.2000	.....	
30,000	.....	.2058	.....	
32,000	.....	.2125	.....	
34,000	.....	.2190	.....	
36,000	.....	.2250	.....	
38,000	.....	.2315	.....	
40,000	.....	.2380	.....	
42,000	.....	.2450	.....	
44,000	.....	.2520	.....	
46,000	.....	.2583	.....	
48,000	.....	.2650	.....	
50,000	.....	.2723	.....	
59,900	20.050	.....	.....	Tensile strength.
	35,780	.....	.....	Shearing strength of bolts.

Sheared bolts in one plane.

No. 9161.

Marks, B 8.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, $4''.05 \times ''.745$.....square inches. 3.017
Shearing area of bolts, $''.73$ diameter.....do.... 1.674

Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0001	.....	
4,000	.....	.0005	.....	
5,000	.....	.0007	.....	
6,000	.....	.0013	.....	
7,000	.....	.0028	.....	
8,000	.....	.0072	.....	
9,000	.....	.0119	.....	
10,000	.....	.0170	.....	
11,000	.....	.0211	.....	
12,000	.....	.0229	.....	
13,000	.....	.0251	.....	
14,000	.....	.0281	.....	
15,000	.....	.0330	.....	
16,000	.....	.0410	.....	
18,000	.....	.0518	.....	
20,000	.....	.0580	.....	
22,000	.....	.0631	.....	
24,000	.....	.0690	.....	
26,000	.....	.0743	.....	
28,000	.....	.0805	.....	
30,000	.....	.0876	.....	
32,000	.....	.0936	.....	
34,000	.....	.1018	.....	
36,000	.....	.1110	.....	
38,000	.....	.1200	.....	
40,000	.....	.1266	.....	
42,000	.....	.1363	.....	
44,000	.....	.1440	.....	
46,000	.....	.1552	.....	
48,000	.....	.1655	.....	
50,000	.....	.1760	.....	
54,300	18,000	.....	.....	Tensile strength.
	32,440	.....	.....	Shearing strength of bolts.

Sheared the bolts in both planes.

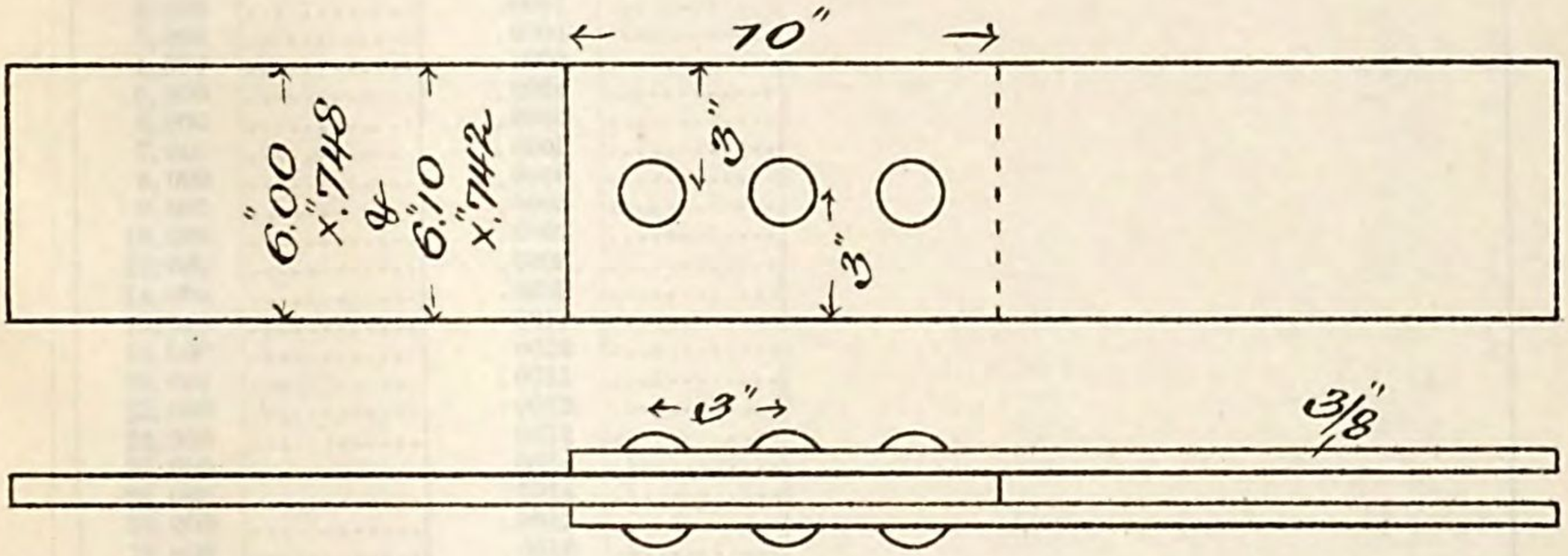
No. 9162.

Marks, B 13.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of web plate, $6''.00 \times ''.748 = 4.488$ square inches.
Gauged length, $6''$.

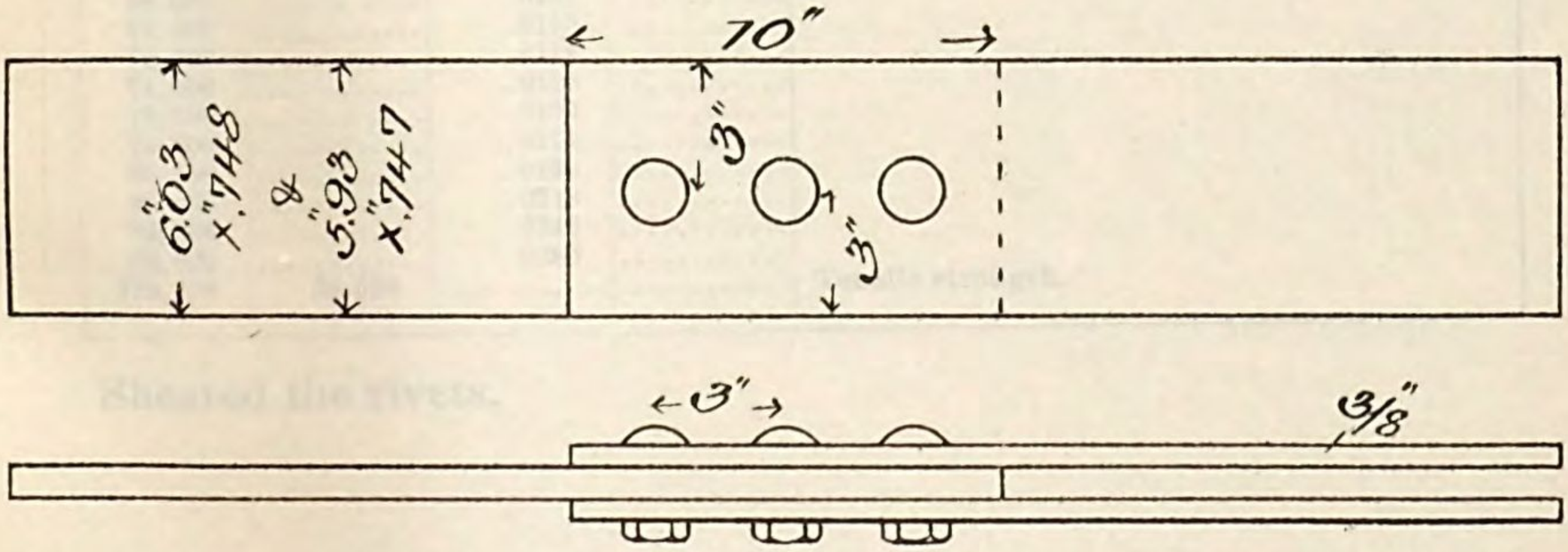
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0001	.....	
4,000	.....	.0001	.....	
5,000	.....	.0002	.....	
6,000	.....	.0003	.....	
7,000	.....	.0004	.....	
8,000	.....	.0004	.....	
9,000	.....	.0005	.....	
10,000	.....	.0006	.....	
12,000	.....	.0008	.....	
14,000	.....	.0009	.....	
16,000	.....	.0010	.....	
18,000	.....	.0012	.....	
20,000	.....	.0014	.....	
22,000	.....	.0015	.....	
24,000	.....	.0017	.....	
26,000	.....	.0019	.....	
28,000	.....	.0021	.....	
30,000	.....	.0024	.....	
32,000	.....	.0027	.....	
34,000	.....	.0035	.....	
36,000	.....	.0060	.....	
38,000	.....	.0065	.....	
40,000	.....	.0071	.....	
42,000	.....	.0075	.....	
44,000	.....	.0078	.....	
46,000	.....	.0085	.....	
48,000	.....	.0090	.....	
50,000	.....	.0100	.....	
52,000	.....	.0121	.....	
54,000	.....	.0136	.....	
56,000	.....	.0151	.....	
58,000	.....	.0163	.....	
60,000	.....	.0176	.....	
62,000	.....	.0182	.....	
64,000	.....	.0189	.....	
66,000	.....	.0198	.....	
68,000	.....	.0201	.....	
70,000	.....	.0209	.....	
72,000	.....	.0242	.....	
74,000	.....	.0318	.....	
76,000	.....	.0350	.....	
78,000	.....	.0380	.....	
80,000	.....	.0430	.....	
139,300	31,040	.....	.....	Tensile strength.

Sheared the rivets.

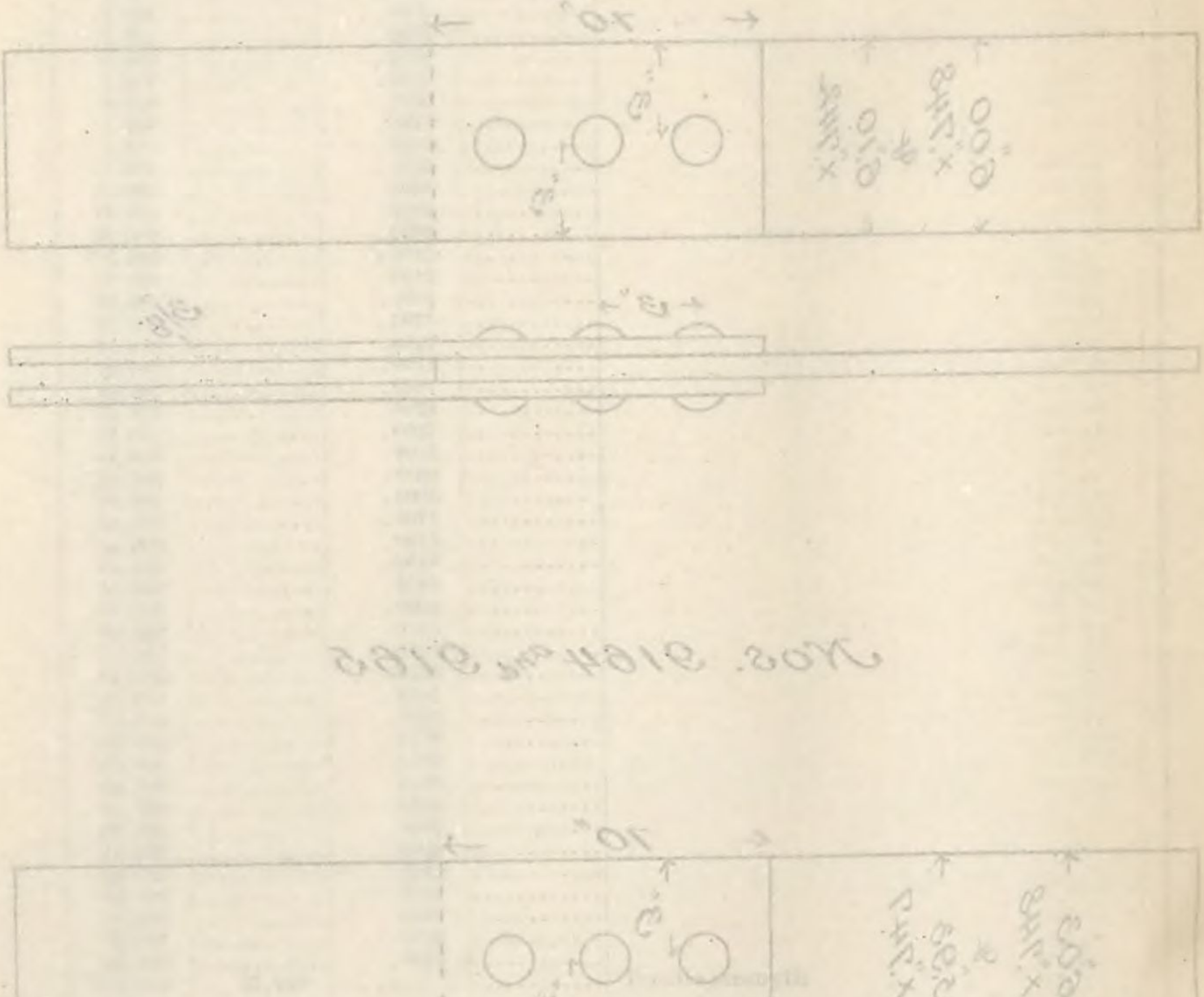
Nos. 9162 and 9163



Nos. 9164 and 9165



No. 9102.



No. 9103.

No. 9163.

Marks, B 14.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of web plate, $6''.10 \times ''.742 = 4.526$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
3,000	.....	.0001	.....	
4,000	.....	.0003	.....	
5,000	.....	.0004	.....	
6,000	.....	.0005	.....	
7,000	.....	.0005	.....	
8,000	.....	.0006	.....	
9,000	.....	.0006	.....	
10,000	.....	.0007	.....	
12,000	.....	.0008	.....	
14,000	.....	.0009	.....	
16,000	.....	0010	.....	
18,000	.....	0010	.....	
20,000	.....	.0011	.....	
22,000	.....	.0012	.....	
24,000	.....	.0013	.....	
26,000	.....	.0014	.....	
28,000	.....	.0014	.....	
30,000	.....	.0015	.....	
32,000	.....	.0016	.....	
34,000	.....	.0018	.....	
36,000	.....	.0020	.....	
38,000	.....	.0022	.....	
40,000	.....	.0022	.....	
42,000	.....	.0023	.....	
44,000	.....	.0024	.....	
46,000	.....	.0026	.....	
48,000	.....	.0030	.....	
50,000	.....	.0060	.....	
52,000	.....	.0066	.....	
54,000	.....	.0070	.....	
56,000	.....	.0075	.....	
58,000	.....	.0081	.....	
60,000	.....	.0085	.....	
62,000	.....	.0090	.....	
64,000	.....	.0093	.....	
66,000	.....	.0096	.....	
68,000	.....	.0101	.....	
70,000	.....	.0110	.....	
72,000	.....	.0118	.....	
74,000	.....	.0125	.....	
76,000	.....	.0133	.....	
78,000	.....	.0171	.....	
80,000	.....	.0199	.....	
82,000	.....	.0218	.....	
84,000	.....	.0345	.....	
86,000	.....	.0380	.....	
129,100	28,520	.....	.....	Tensile strength.

Sheared the rivets.

No. 9164.

Marks, B 15.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, 6''.03 × .748.....square inches.. 4.510
Shearing area of bolts, ''.73 diameter.....do.... 2.511

Gauged length, 6''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	The nuts were not screwed down very hard.
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0005	.....	
6,000	.....	.0160	.....	
7,000	.....	.0201	.....	
8,000	.....	.0238	.....	
9,000	.....	.0269	.....	
10,000	.....	.0290	.....	
12,000	.....	.0356	.....	
14,000	.....	.0400	.....	
16,000	.....	.0431	.....	
18,000	.....	.0465	.....	
20,000	.....	.0495	.....	
22,000	.....	.0534	.....	
24,000	.....	.0590	.....	
26,000	.....	.0659	.....	
28,000	.....	.0719	.....	
30,000	.....	.0766	.....	
32,000	.....	.0810	.....	
34,000	.....	.0852	.....	
36,000	.....	.0900	.....	
38,000	.....	.0933	.....	
40,000	.....	.0972	.....	
42,000	.....	.1017	.....	
44,000	.....	.1060	.....	
46,000	.....	.1109	.....	
48,000	.....	.1160	.....	
50,000	.....	.1212	.....	
52,000	.....	.1255	.....	
54,000	.....	.1310	.....	
56,000	.....	.1355	.....	
58,000	.....	.1390	.....	
60,000	.....	.1456	.....	
62,000	.....	.1490	.....	
64,000	.....	.1531	.....	
66,000	.....	.1565	.....	
68,000	.....	.1610	.....	
70,000	.....	.1650	.....	
112,800	25,010	.....	.....	Tensile strength; sheared the bolts.
	44,920	.....	.....	Shearing strength of bolts.

No. 9165.

Marks, B 16.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, $5''.93 \times ''.747$ ..... square inches.. 4.430
Shearing area of bolts, $''.73$ diameter ..... do 2.511

Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	The nuts were screwed down hard.
3,000	.....	.0001	.....	
4,000	.....	.0002	.....	
5,000	.....	.0004	.....	
6,000	.....	.0006	.....	
7,000	.....	.0010	.....	
8,000	.....	.0012	.....	
9,000	.....	.0150	.....	
10,000	.....	.0199	.....	
12,000	.....	.0325	.....	
14,000	.....	.0364	.....	
16,000	.....	.0480	.....	
18,000	.....	.0522	.....	
20,000	.....	.0559	.....	
22,000	.....	.0580	.....	
24,000	.....	.0622	.....	
26,000	.....	.0675	.....	
28,000	.....	.0719	.....	
30,000	.....	.0760	.....	
32,000	.....	.0820	.....	
34,000	.....	.0889	.....	
36,000	.....	.0940	.....	
38,000	.....	.1002	.....	
40,000	.....	.1051	.....	
42,000	.....	.1117	.....	
44,000	.....	.1180	.....	
46,000	.....	.1220	.....	
48,000	.....	.1290	.....	
50,000	.....	.1322	.....	
52,000	.....	.1380	.....	
54,000	.....	.1426	.....	
56,000	.....	.1480	.....	
58,000	.....	.1540	.....	
60,000	.....	.1600	.....	
62,000	.....	.1652	.....	
64,000	.....	.1721	.....	
66,000	.....	.1772	.....	
68,000	.....	.1830	.....	
70,000	.....	.1900	.....	
78,500 {	17,720	.....	.....	Tensile strength; sheared the bolts.
	31,260	.....	.....	Shearing strength of bolts.

No. 9166.

Marks, B 21.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, 8''.04 × ''.753 ..... square inches.. 6.054
Net sectional area of covers, 7.196 × .716 ..... do.... 5.152

Gauged length, 6''.

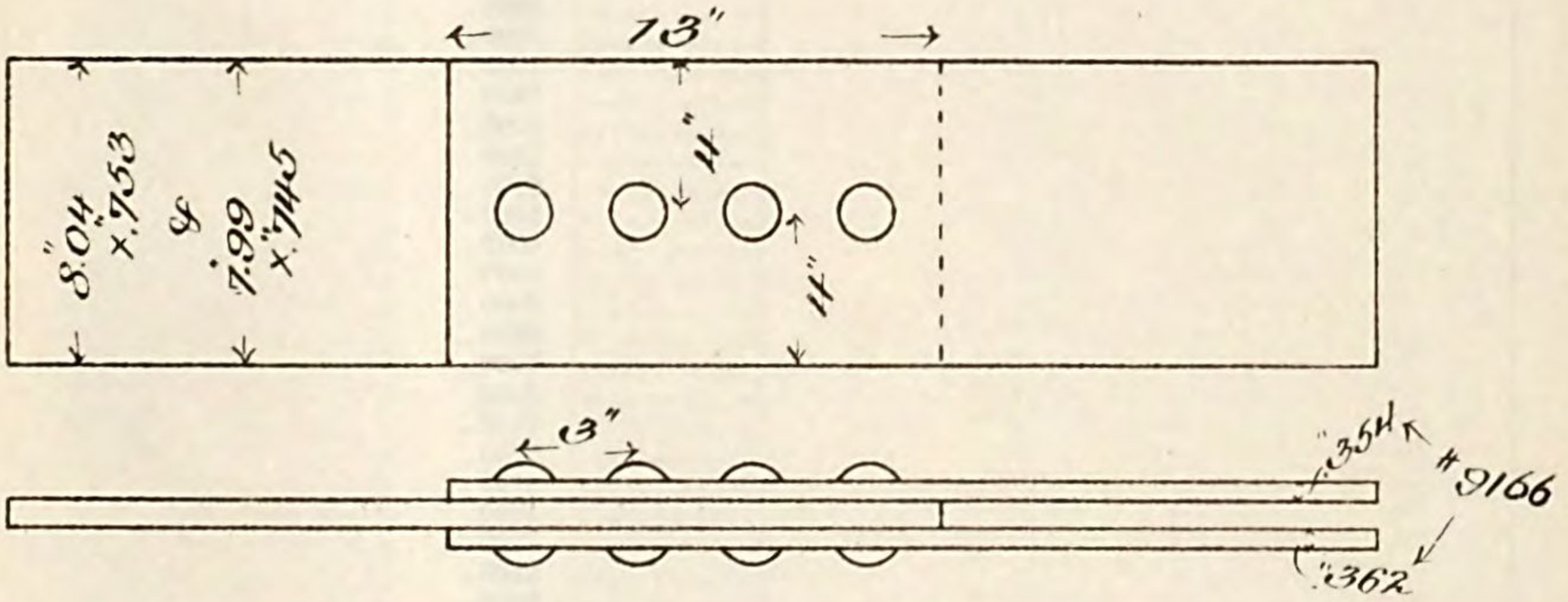
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	
3,000	.....	.0000	.....	
4,000	.....	.0000	.....	
5,000	.....	.0000	.....	
6,000	.....	.0000	.....	
7,000	.....	.0000	.....	
8,000	.....	.0000	.....	
9,000	.....	.0001	.....	
10,000	.....	.0001	.....	
12,000	.....	.0002	.....	
14,000	.....	.0002	.....	
16,000	.....	.0004	.....	
18,000	.....	.0005	.....	
20,000	.....	.0006	.....	
24,000	.....	.0009	.....	
28,000	.....	.0011	.....	
32,000	.....	.0012	.....	
36,000	.....	.0015	.....	
40,000	.....	.0020	.....	
44,000	.....	.0028	.....	
48,000	.....	.0068	.....	
52,000	.....	.0072	.....	
56,000	.....	.0084	.....	
60,000	.....	.0093	.....	
64,000	.....	.0100	.....	
68,000	.....	.0115	.....	
72,000	.....	.0122	.....	
76,000	.....	.0130	.....	
80,000	.....	.0140	.....	
84,000	.....	.0151	.....	
88,000	.....	.0160	.....	
92,000	.....	.0175	.....	
96,000	.....	.0190	.....	
100,000	.....	.0203	.....	
104,000	.....	.0224	.....	
108,000	.....	.0241	.....	
112,000	.....	.0278	.....	
116,000	.....	.0310	.....	
120,000	.....	.0353	.....	
124,000	.....	.0390	.....	
128,000	.....	.0424	.....	
132,000	.....	.0480	.....	
175,400	28,970	.....	.....	Tensile strength.

Fractured covers through outside rivet holes. Granular.

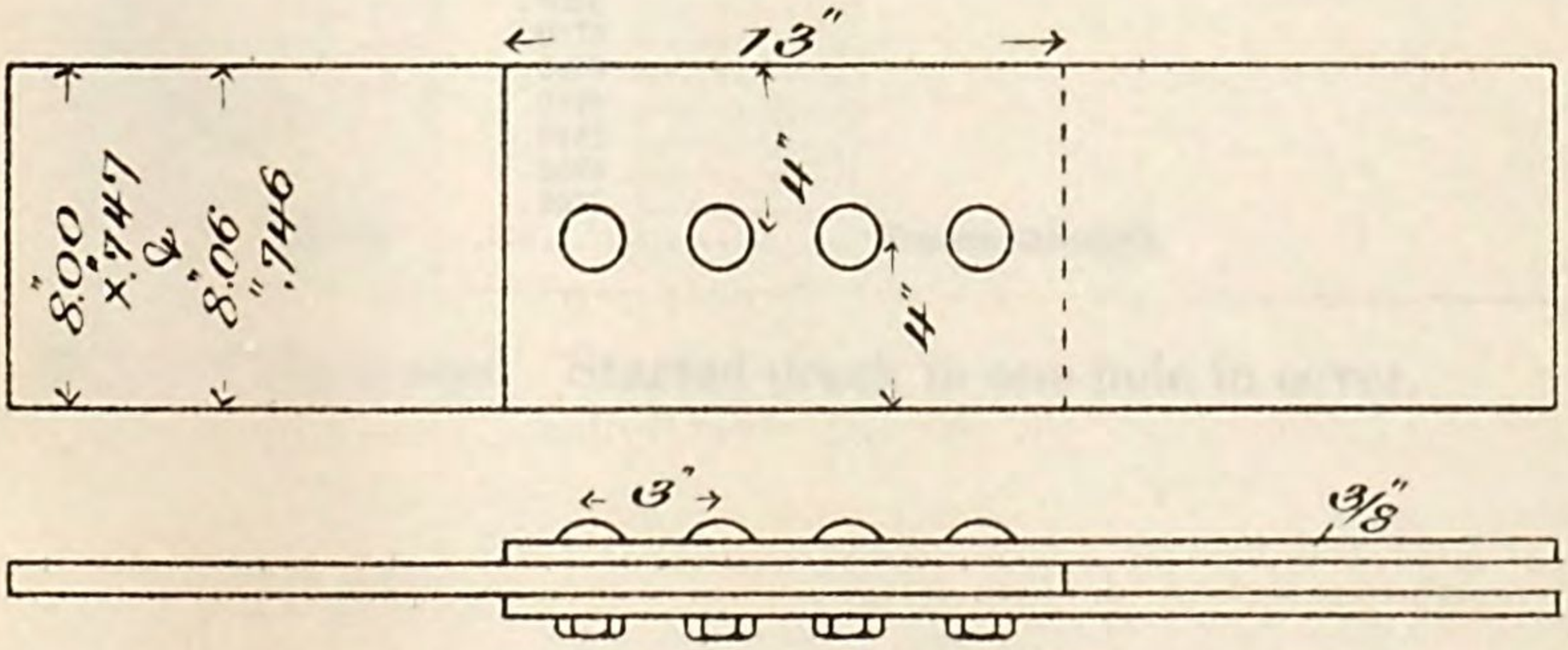
Maximum stress on joint.

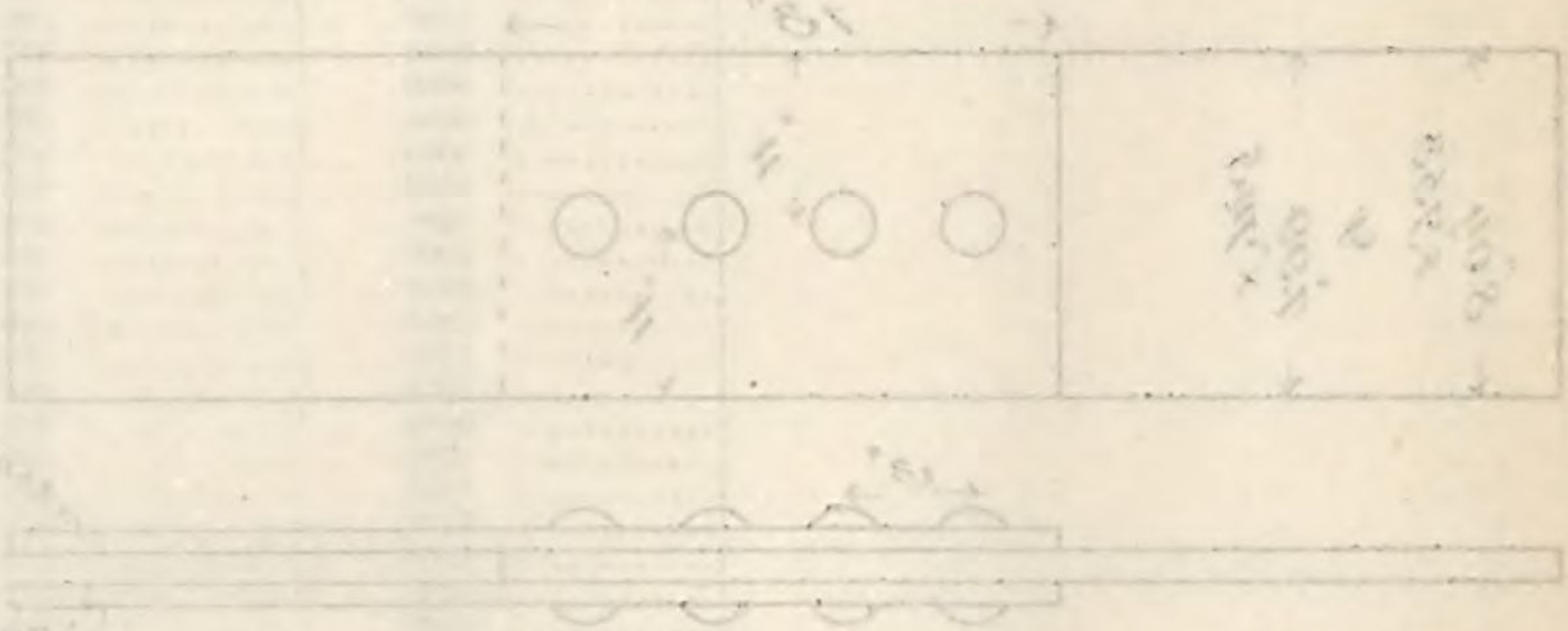
Tension on gross section of plate ..... pounds per square inch.. 28,970
Tension on net section of covers ..... do.... 34,040

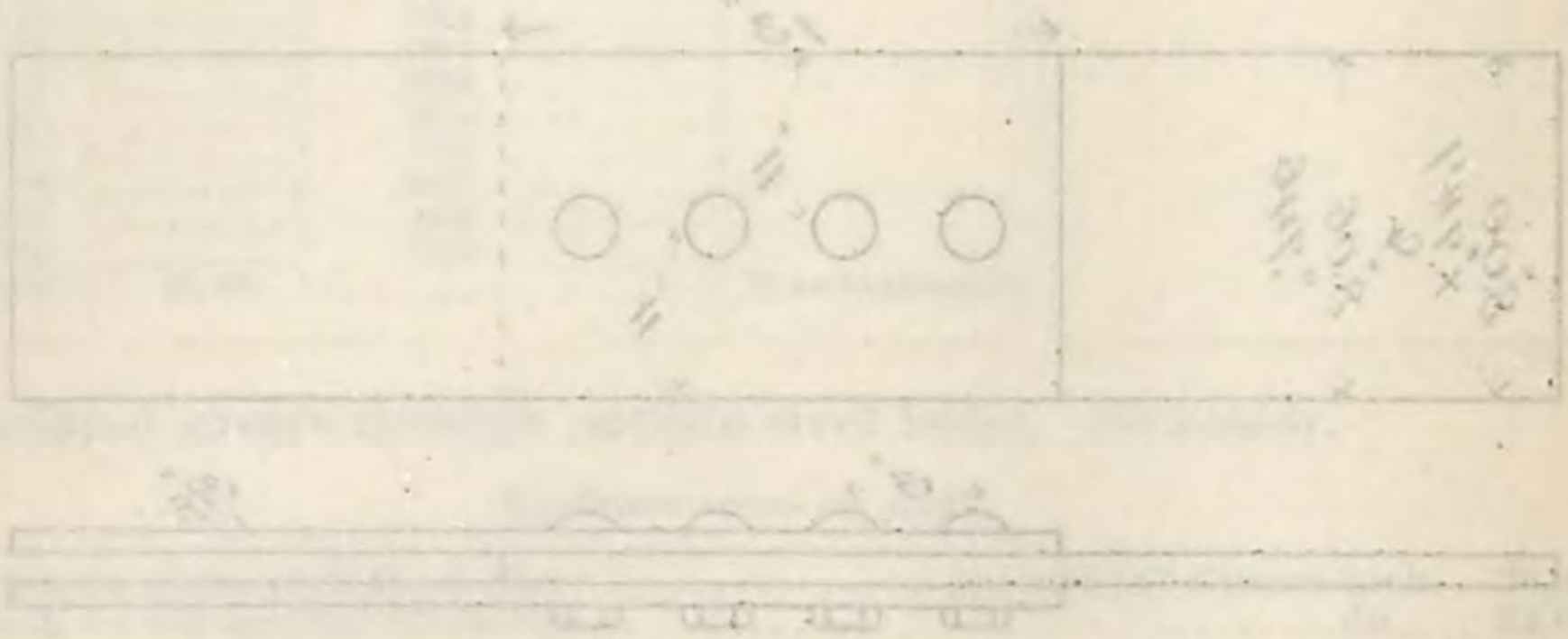
Nos. 9166 and 9167.



Nos. 9168 and 9169.







No. 9167.

Marks, B 22.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron rivets.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.
Gross sectional area of web plate, $7''.99 \times ''.745 = 5.952$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	
3,000	.....	.0000	.....	
4,000	.....	.0000	.....	
5,000	.....	.0001	.....	
6,000	.....	.0001	.....	
7,000	.....	.0001	.....	
8,000	.....	.0001	.....	
9,000	.....	.0002	.....	
10,000	.....	.0002	.....	
12,000	.....	.0002	.....	
14,000	.....	.0003	.....	
16,000	.....	.0004	.....	
18,000	.....	.0006	.....	
20,000	.....	.0008	.....	
24,000	.....	.0009	.....	
28,000	.....	.0011	.....	
32,000	.....	.0013	.....	
36,000	.....	.0016	.....	
40,000	.....	.0018	.....	
44,000	.....	.0021	.....	
48,000	.....	.0037	.....	
52,000	.....	.0042	.....	
56,000	.....	.0052	.....	
60,000	.....	.0081	.....	
64,000	.....	.0088	.....	
68,000	.....	.0092	.....	
72,000	.....	.0099	.....	
76,000	.....	.0107	.....	
80,000	.....	.0210	.....	
84,000	.....	.0219	.....	
88,000	.....	.0222	.....	
92,000	.....	.0233	.....	
96,000	.....	.0249	.....	
100,000	.....	.0270	.....	
104,000	.....	.0318	.....	
108,000	.....	.0350	.....	
112,000	.....	.0375	.....	
116,000	.....	.0406	.....	
120,000	.....	.0440	.....	
124,000	.....	.0482	.....	
128,000	.....	.0528	.....	
132,000	.....	.0577	.....	
169,480	28,470	.....	.....	Tensile strength.

Sheared the rivets. Started crack in one hole in cover.

No. 9168.

Marks, B 23.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ steel bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, 8".00×".747 ..... square inches.. 5.976
Shearing area of bolts, ".73 diameter ..... do.... 3.348

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0000	.....	
3,000	.....	.0001	.....	
4,000	.....	.0001	.....	
5,000	.....	.0001	.....	
6,000	.....	.0002	.....	
7,000	.....	.0004	.....	
8,000	.....	.0005	.....	
9,000	.....	.0006	.....	
10,000	.....	.0008	.....	
12,000	.....	.0012	.....	
13,000	.....	.0298	.....	
14,000	.....	.0327	.....	
16,000	.....	.0372	.....	
18,000	.....	.0435	.....	
20,000	.....	.0481	.....	
24,000	.....	.0518	.....	
28,000	.....	.0669	.....	
32,000	.....	.0727	.....	
36,000	.....	.0800	.....	
40,000	.....	.0870	.....	
44,000	.....	.0942	.....	
48.000	.....	.1039	.....	
52,000	.....	.1120	.....	
56,000	.....	.1200	.....	
60,000	.....	.1260	.....	
64,000	.....	.1318	.....	
68,000	.....	.1381	.....	
72,000	.....	.1440	.....	
76,000	.....	.1500	.....	
80,000	.....	.1573	.....	
140,100	23,440	.....	.....	Tensile strength.
	41,840	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9169.

Marks, B 24.
$\frac{3}{4}''$ steel plate, $\frac{3}{4}''$ iron bolts.
Punched holes; punch $\frac{13}{16}''$, die $\frac{7}{8}''$ diameter.

Gross sectional area of web plate, 8″.06 × ″.746.....square inches.. 6.013
Shearing area of bolts, ″.73 diameter.....do.... 3.348

Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0006	.....	
2,000	.....	.0000	.....	
3,000	.....	.0000	.....	
4,000	.....	.0000	.....	
5,000	.....	.0001	.....	
6,000	.....	.0001	.....	
7,000	.....	.0003	.....	
8,000	.....	.0004	.....	
9,000	.....	.0005	.....	
10,000	.....	.0006	.....	
12,000	.....	.0008	.....	
14,000	.....	.0010	.....	
15,000	.....	.0014	.....	
16,000	.....	.0020	.....	
17,000	.....	.0042	.....	
18,000	.....	.0059	.....	
20,000	.....	.0083	.....	
24,000	.....	.0201	.....	
28,000	.....	.0328	.....	
32,000	.....	.0453	.....	
36,000	.....	.0611	.....	
40,000	.....	.0729	.....	
44,000	.....	.0819	.....	
48,000	.....	.0912	.....	
52,000	.....	.0991	.....	
56,000	.....	.1050	.....	
60,000	.....	.1131	.....	
64,000	.....	.1180	.....	
68,000	.....	.1258	.....	
72,000	.....	.1315	.....	
76,000	.....	.1400	.....	
80,000	.....	.1475	.....	
114,200	18,990	.....	.....	Tensile strength.
	34,110	.....	.....	Shearing strength of bolts.

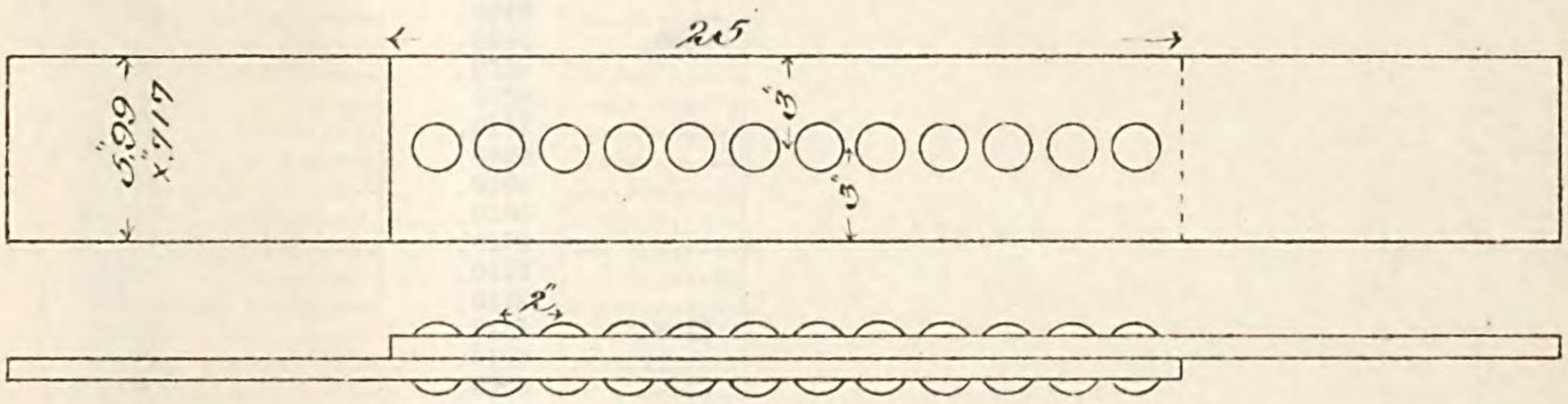
Sheared the bolts.

No. 9380.

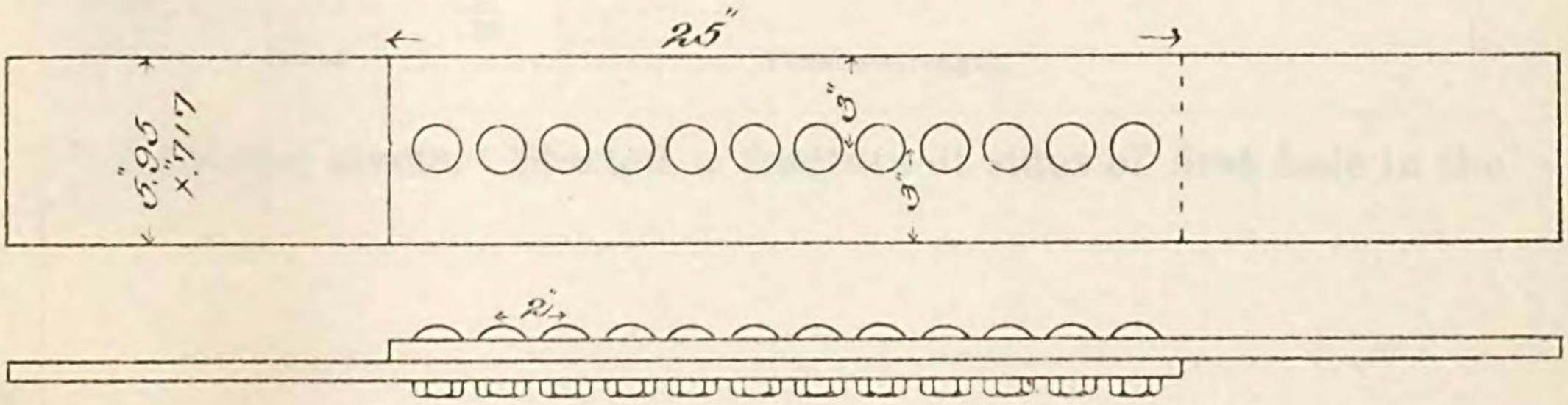
Marks, T 3.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}$ diameter.
Gross sectional area of plate, $5''.99 \times ''.717 = 4.29$ square inches.
Gauged length, $26''$.

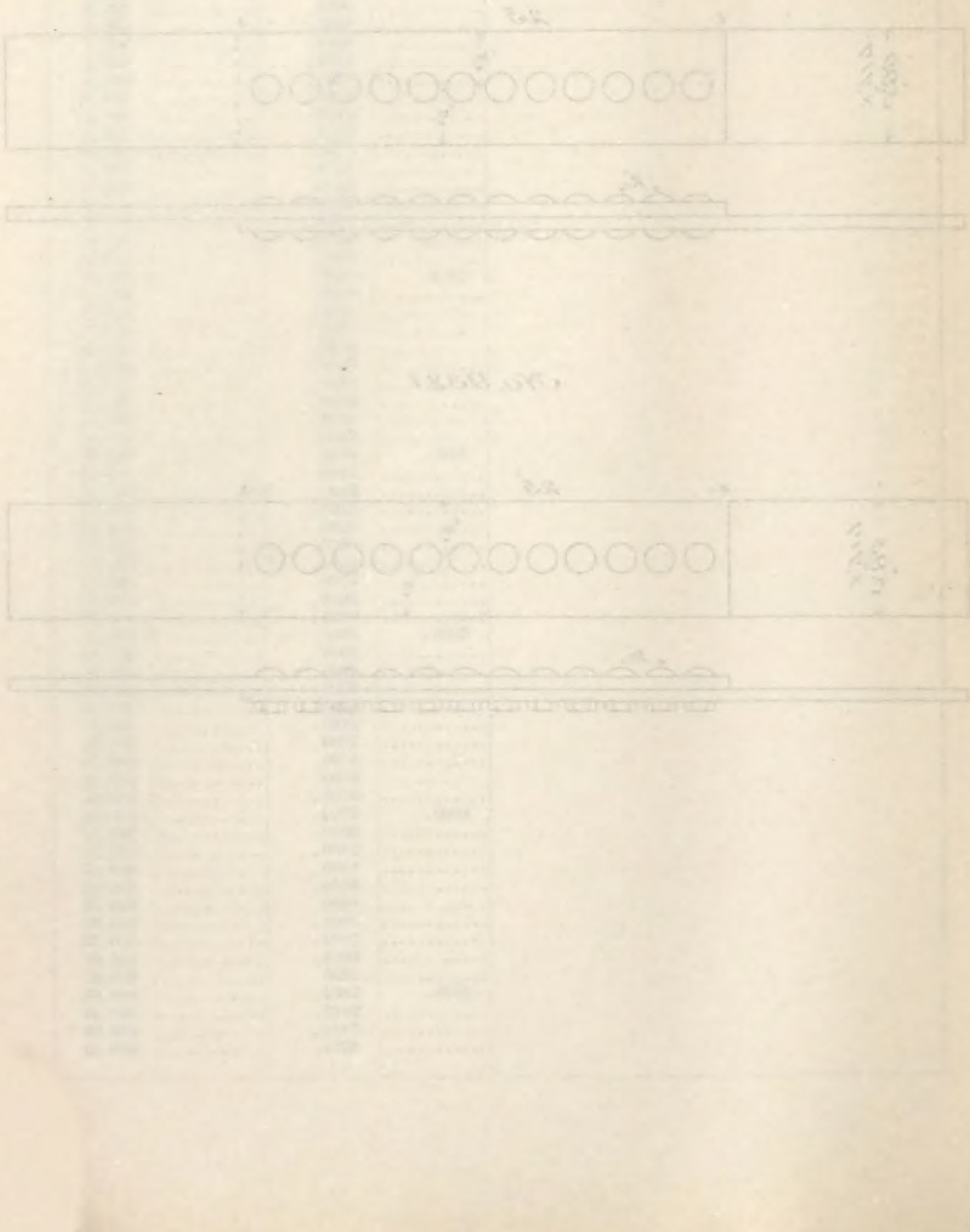
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
1,500	.....	.0002	.....	
2,000	.....	.0003	.....	
2,500	.....	.0003	.....	
3,000	.....	.0004	.....	
4,000	.....	.0005	.....	
5,000	.....	.0006	.....	
6,000	.....	.0007	.....	
7,000	.....	.0009	.....	
8,000	.....	.0010	.....	
9,000	.....	.0011	.....	
10,000	.....	.0013	.....	
11,000	.....	.0014	.....	
12,000	.....	.0015	.....	
13,000	.....	.0017	.....	
14,000	.....	.0019	.....	
15,000	.....	.0020	.....	
16,000	.....	.0022	.....	
17,000	.....	.0024	.....	
18,000	.....	.0025	.....	
19,000	.....	.0026	.....	
20,000	.....	.0028	.0002	
21,000	.....	.0030	.....	
22,000	.....	.0031	.....	
23,000	.....	.0033	.....	
24,000	.....	.0034	.....	
25,000	.....	.0035	.....	
26,000	.....	.0038	.....	
27,000	.....	.0039	.....	
28,000	.....	.0040	.....	
29,000	.....	.0042	.....	
30,000	.....	.0044	.0003	
31,000	.....	.0045	.....	
32,000	.....	.0046	.....	
33,000	.....	.0048	.....	
34,000	.....	.0049	.....	
35,000	.....	.0050	.....	
36,000	.....	.0052	.....	
37,000	.....	.0054	.....	
38,000	.....	.0056	.....	
39,000	.....	.0058	.....	
40,000	.....	.0060	.0003	
41,000	.....	.0062	.....	
42,000	.....	.0064	.....	
43,000	.....	.0066	.....	
44,000	.....	.0068	.....	
45,000	.....	.0070	.....	
46,000	.....	.0072	.....	
47,000	.....	.0074	.....	
48,000	.....	.0076	.....	
49,000	.....	.0078	.....	
50,000	.....	.0079	.0004	
51,000	.....	.0080	.....	
52,000	.....	.0082	.....	
53,000	.....	.0084	.....	
54,000	.....	.0086	.....	
55,000	.....	.0088	.....	
56,000	.....	.0090	.....	
57,000	.....	.0091	.....	
58,000	.....	.0093	.....	
59,000	.....	.0095	.....	
60,000	.....	.0097	.0005	
61,000	.....	.0100	.....	
62,000	.....	.0102	.....	
63,000	.....	.0105	.....	

No. 9380.



No. 9381





No. 9380—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
64,000	.....	.0107	.....	
65,000	.....	.0109	.....	
66,000	.....	.0111	.....	
67,000	.....	.0113	.....	
68,000	.....	.0115	.....	
69,000	.....	.0117	.....	
70,000	.....	.0119	.0009	
71,000	.....	.0121	.....	
72,000	.....	.0124	.....	
73,000	.....	.0126	.....	
74,000	.....	.0128	.....	
75,000	.....	.0130	.....	
76,000	.....	.0132	.....	
77,000	.....	.0135	.....	
78,000	.....	.0138	.....	
79,000	.....	.0140	.....	
80,000	.....	.0144	.0020	
81,000	.....	.0150	.....	
82,000	.....	.0155	.....	
83,000	.....	.0157	.....	
84,000	.....	.0160	.....	
85,000	.....	.0163	.....	
86,000	.....	.0166	.....	
87,000	.....	.0170	.....	
88,000	.....	.0173	.....	
89,000	.....	.0178	.....	
90,000	.....	.0185	.0042	
91,000	.....	.0189	.....	
92,000	.....	.0260	.0113	
93,000	.....	.0262	.....	
94,000	.....	.0265	.....	
95,000	.....	.0270	.....	
96,000	.....	.0274	.....	
97,000	.....	.0280	.....	
98,000	.....	.0284	.....	
99,000	.....	.0289	.....	
100,000	.....	.0301	.0141	
120,000	.....	.04	.....	
123,000	.....	.....	.....	Scale started off plate.
130,000	.....	.06	.....	
140,000	.....	.13	.....	
150,000	.....	.21	.....	
160,000	.....	.30	.....	
169,900	39,600	.....	.....	Tensile strength.

Sheared the rivets. Started a fracture at sides of first hole in the plate.

No. 9381.

Marks, T 4.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

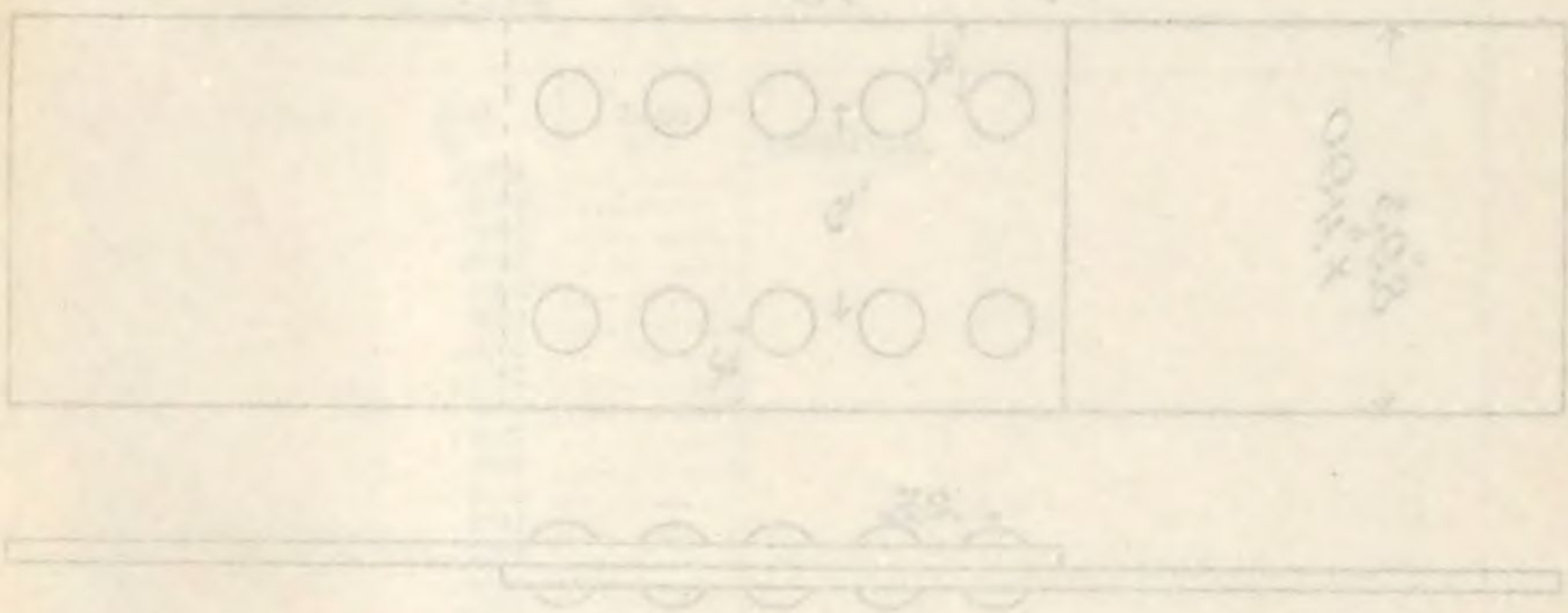
Gross sectional area of plate, $5''.95 \times ''.717$.....square inches.. 4.27
Shearing area of bolts, $''.61$ diameter.....do.... 3.50

Gauged length, $26''$.

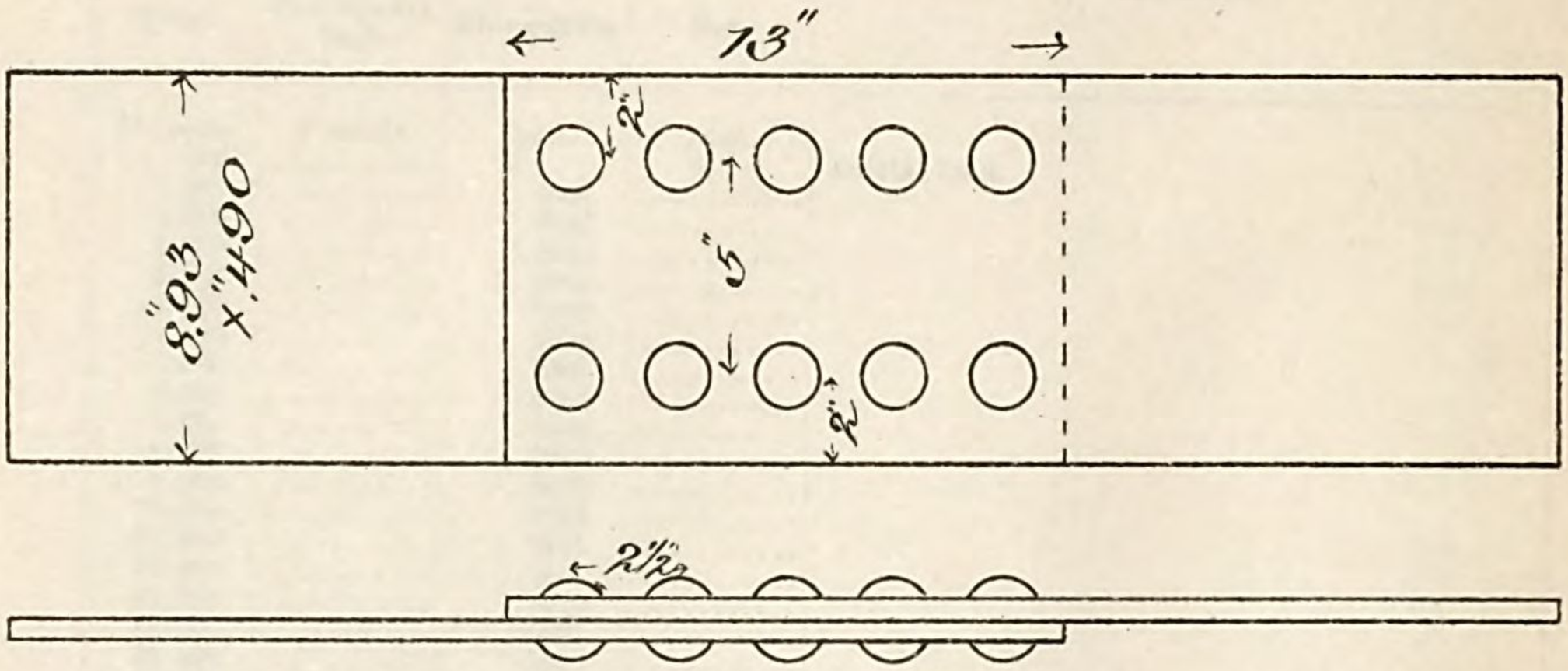
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0002	.....	
2,000	.....	.0003	.....	
2,500	.....	.0004	.....	
3,000	.....	.0005	.....	
4,000	.....	.0006	.....	
5,000	.....	.0007	.....	
6,000	.....	.0008	.....	
7,000	.....	.0009	.....	
8,000	.....	.0010	.....	
9,000	.....	.0012	.....	
10,000	.....	.0014	.....	
11,000	.....	.0015	.....	
12,000	.....	.0017	.....	
13,000	.....	.0019	.....	
14,000	.....	.0021	.....	
15,000	.....	.0023	.....	
16,000	.....	.0025	.....	
17,000	.....	.0027	.....	
18,000	.....	.0028	.....	
19,000	.....	.0030	.....	
20,000	.....	.0032	.0003	
21,000	.....	.0034	.....	
22,000	.....	.0036	.....	
23,000	.....	.0038	.....	
24,000	.....	.0040	.....	
25,000	.....	.0044	.....	
26,000	.....	.0046	.....	
27,000	.....	.0048	.....	
28,000	.....	.0051	.....	
29,000	.....	.0054	.....	
30,000	.....	.0057	.0009	
31,000	.....	.0076	.....	
32,000	.....	.0081	.....	
33,000	.....	.0107	.....	
34,000	.....	.0140	.....	
35,000	.....	.0300	.....	
37,000	.....	.03	.....	
38,000	.....	.05	.....	
39,000	.....	.05+	.....	
40,000	.....	.07	.....	
44,000	.....	.08	.....	
48,000	.....	.10	.....	
50,000	.....	.11	.....	
54,000	.....	.12	.....	
58,000	.....	.12+	.....	
60,000	.....	.13	.....	
64,000	.....	.13+	.....	
68,000	.....	.15	.....	
72,000	.....	.16	.....	
76,000	.....	.17	.....	
80,000	.....	.18	.....	
84,000	.....	.18+	.....	
88,000	.....	.19	.....	
92,000	.....	.20	.....	
96,000	.....	.21	.....	
100,000	.....	.22	.....	
110,000	.....	.24	.....	
113,100	26,490	.....	.....	Tensile strength.
	32,310	.....	.....	Shearing strength of bolts.

Sheared the bolts.

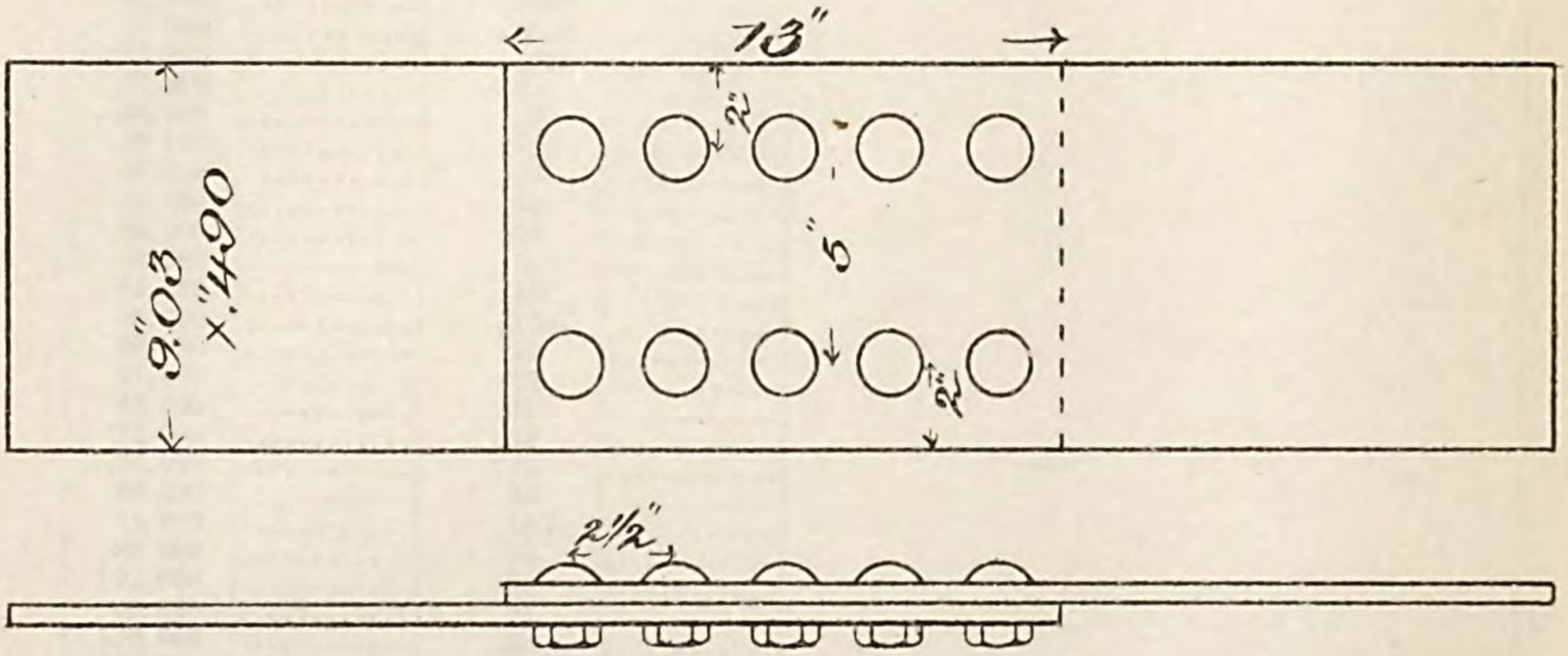
A number of the bolts had their threads cut beyond the shearing plane.



No. 9382.



No. 9383.



No. 9382.

Marks, T 21.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, $8''.93 \times ''.490$.....square inches.. 4.38
Net sectional area of plate, $7''.49 \times ''.490$ .....do.... 3.67

Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0001	.....	
2,000	.....	.0001	.....	
2,500	.....	.0002	.....	
3,000	.....	.0002	.....	
4,000	.....	.0003	.....	
5,000	.....	.0005	.....	
6,000	.....	.0006	.....	
7,000	.....	.0007	.....	
8,000	.....	.0007	.....	
9,000	.....	.0009	.....	
10,000	.....	.0010	.....	
11,000	.....	.0011	.....	
12,000	.....	.0012	.....	
13,000	.....	.0013	.....	
14,000	.....	.0014	.....	
15,000	.....	.0015	.....	
16,000	.....	.0016	.....	
17,000	.....	.0016	.....	
18,000	.....	.0017	.....	
19,000	.....	.0019	.....	
20,000	.....	.0020	0.	
21,000	.....	.0021	.....	
22,000	.....	.0022	.....	
23,000	.....	.0023	.....	
24,000	.....	.0025	.....	
25,000	.....	.0026	.....	
26,000	.....	.0027	.....	
27,000	.....	.0028	.....	
28,000	.....	.0030	.....	
29,000	.....	.0031	.....	
30,000	.....	.0032	0.	
31,000	.....	.0033	.....	
32,000	.....	.0034	.....	
33,000	.....	.0036	.....	
34,000	.....	.0037	.....	
35,000	.....	.0038	.....	
36,000	.....	.0039	.....	
37,000	.....	.0040	.....	
38,000	.....	.0042	.....	
39,000	.....	.0043	.....	
40,000	.....	.0045	.0001	
41,000	.....	.0046	.....	
42,000	.....	.0047	.....	
43,000	.....	.0048	.....	
44,000	.....	.0050	.....	
45,000	.....	.0051	.....	
46,000	.....	.0053	.....	
47,000	.....	.0054	.....	
48,000	.....	.0056	.....	
49,000	.....	.0057	.....	
50,000	.....	.0058	0001	
51,000	.....	.0060	.....	
52,000	.....	.0062	.....	
53,000	.....	.0063	.....	
54,000	.....	.0064	.....	
55,000	.....	.0066	.....	
56,000	.....	.0067	.....	
57,000	.....	.0069	.....	
58,000	.....	.0070	.....	
59,000	.....	.0072	.....	
60,000	.....	.0074	.0005	
61,000	.....	.0076	.....	
62,000	.....	.0078	.....	

No. 9382—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
63,000	.....	.0080	.....	
64,000	.....	.0082	.....	
65,000	.....	.0084	.....	
66,000	.....	.0085	.....	
67,000	.....	.0086	.....	
68,000	.....	.0089	.....	
69,000	.....	.0091	.....	
70,000	.....	.0093	.0011	
71,000	.....	.0096	.....	
72,000	.....	.0101	.....	
73,000	.....	.0104	.....	
74,000	.....	.0106	.....	
75,000	.....	.0112	.....	
76,000	.....	.0116	.....	
77,000	.....	.0120	.....	
78,000	.....	.0124	.....	
79,000	.....	.0127	.....	
80,000	.....	.0132	.0035	
81,000	.....	.0141	.....	
82,000	.....	.0146	.....	
83,000	.....	.0150	.....	
84,000	.....	.0156	.....	
85,000	.....	.0161	.....	
86,000	.....	.0166	.....	
87,000	.....	.0171	.....	
88,000	.....	.0175	.....	
89,000	.....	.0176	.....	
90,000	.....	.0181	.0071	
91,000	.....	.0187	.....	
92,000	.....	.0192	.....	
93,000	.....	.0194	.....	
94,000	.....	.0196	.....	
95,000	.....	.0200	.....	
96,000	.....	.0202	.....	
97,000	.....	.0205	.....	
98,000	.....	.0208	.....	
99,000	.....	.0211	.....	
100,000	.....	.0215	.0091	
101,000	.....	.0221	.....	
102,000	.....	.0224	.....	
103,000	.....	.0226	.....	
104,000	.....	.0229	.....	
105,000	.....	.0232	.....	
106,000	.....	.0237	.....	
107,000	.....	.0242	.....	
108,000	.....	.0246	.....	
109,000	.....	.0249	.....	
110,000	.....	.0256	.0111	
111,000	.....	.0270	.....	
112,000	.....	.0272	.....	
113,000	.....	.0276	.....	
114,000	.....	.0281	.....	
115,000	.....	.0288	.....	
116,000	.....	.0294	.....	
117,000	.....	.0330	.....	
120,000	.....	.04	.....	
130,000	.....	.06	.....	
140,000	.....	.07	.....	
150,000	.....	.12	.....	
157,400	35,940	.....	.....	Tensile strength.

Fractured plate across first row of rivet holes. Granular.

Maximum stress on joint.

Tension on gross section of plate.....pounds per square inch.. 35,940
Tension on net section of plate.....do.... 42,890

No. 9383.

Marks, T 22.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, $9''.03 \times ''.490$ ..... square inches .. 4.42
Shearing area of bolts, $''.61$ diameter ..... do 2.92

Gauged length, $15''$.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0001	.....	
2,000	.....	.0002	.....	
2,500	.....	.0002	.....	
3,000	.....	.0003	.....	
4,000	.....	.0003	.....	
5,000	.....	.0004	.....	
6,000	.....	.0005	.....	
7,000	.....	.0006	.....	
8,000	.....	.0007	.....	
9,000	.....	.0008	.....	
10,000	.....	.0009	.....	
11,000	.....	.0010	.....	
12,000	.....	.0011	.....	
13,000	.....	.0012	.....	
14,000	.....	.0014	.....	
15,000	.....	.0016	.....	
16,000	.....	.0017	.....	
17,000	.....	.0018	.....	
18,000	.....	.0019	.....	
19,000	.....	.0020	.....	
20,000	.....	.0022	.0002	
21,000	.....	.0024	.....	
22,000	.....	.0025	.....	
23,000	.....	.0026	.....	
24,000	.....	.0028	.....	
25,000	.....	.0030	.....	
26,000	.....	.0033	.....	
27,000	.....	.0036	.....	
28,000	.....	.0041	.....	
29,000	.....	.06	.....	
30,000	.....	.06	.....	
32,000	.....	.07	.....	
36,000	.....	.08	.....	
40,000	.....	.09	.....	
44,000	.....	.10	.....	
48,000	.....	.11	.....	
50,000	.....	.11+	.....	
54,000	.....	.12	.....	
58,000	.....	.13	.....	
60,000	.....	.13+	.....	
64,000	.....	.15	.....	
68,000	.....	.16	.....	
72,000	.....	.17	.....	
76,000	.....	.18	.....	
80,000	.....	.20	.....	
84,000	19,000	.23	.....	Tensile strength.
	28,770	.....	.....	Shearing strength of bolts.

Sheared the bolts.
Bolts in part found in loose condition. They were all set up before testing, using a wrench of $14''$ leverage.

No. 9384.

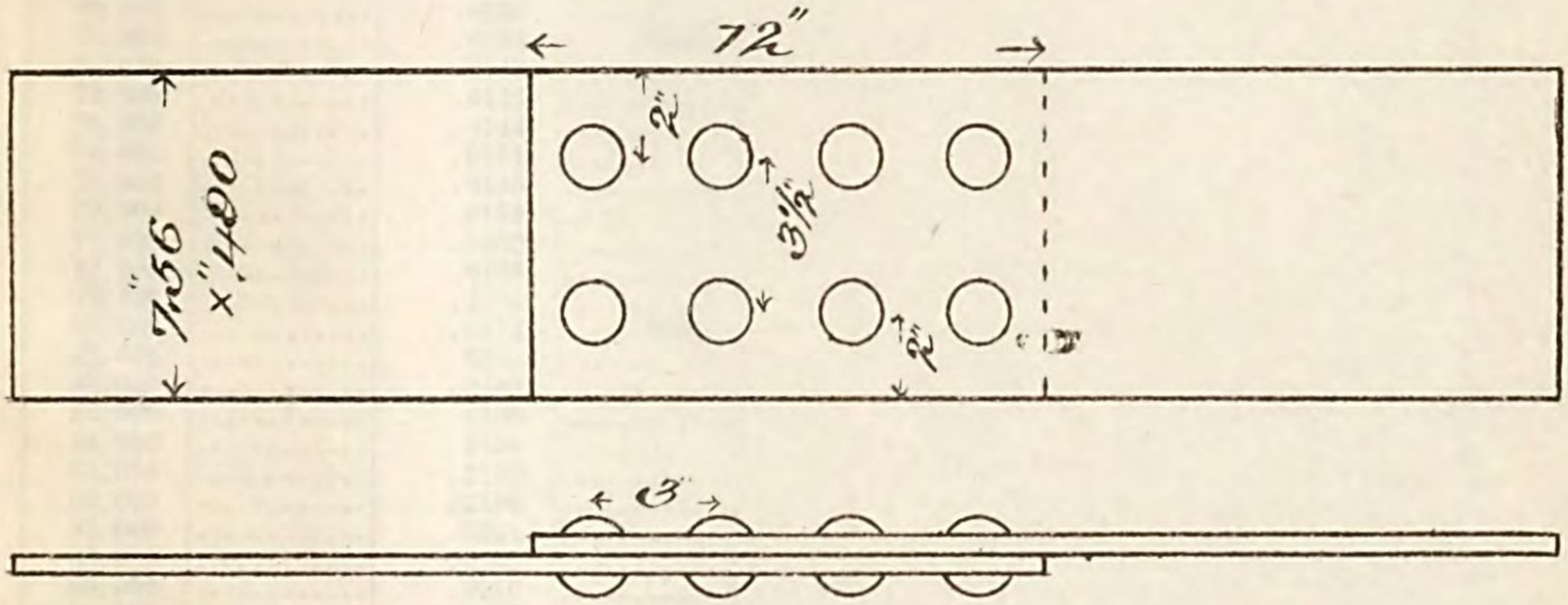
Marks, T 13.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, 7".56 × ".490 ..... square inches.. 3.70
Net sectional area of plate, 6".12 × ".490 ..... do.... 3.00

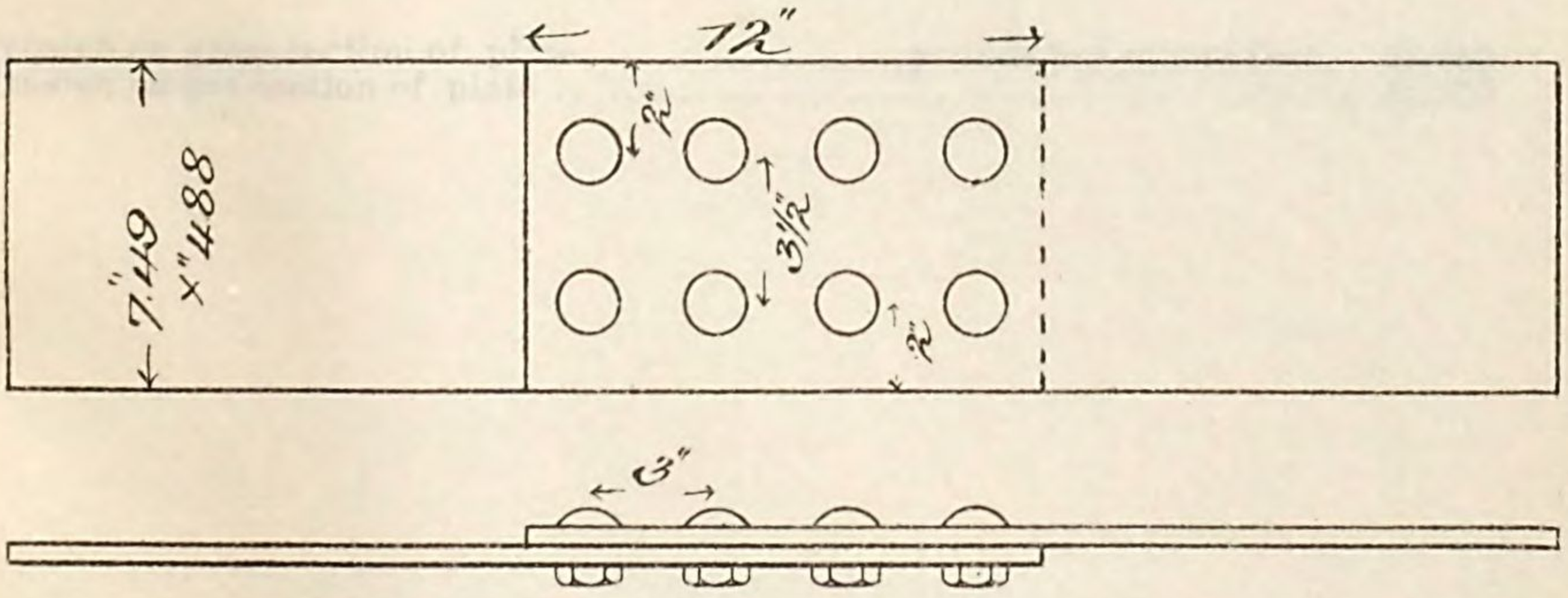
Gauged length, 15".

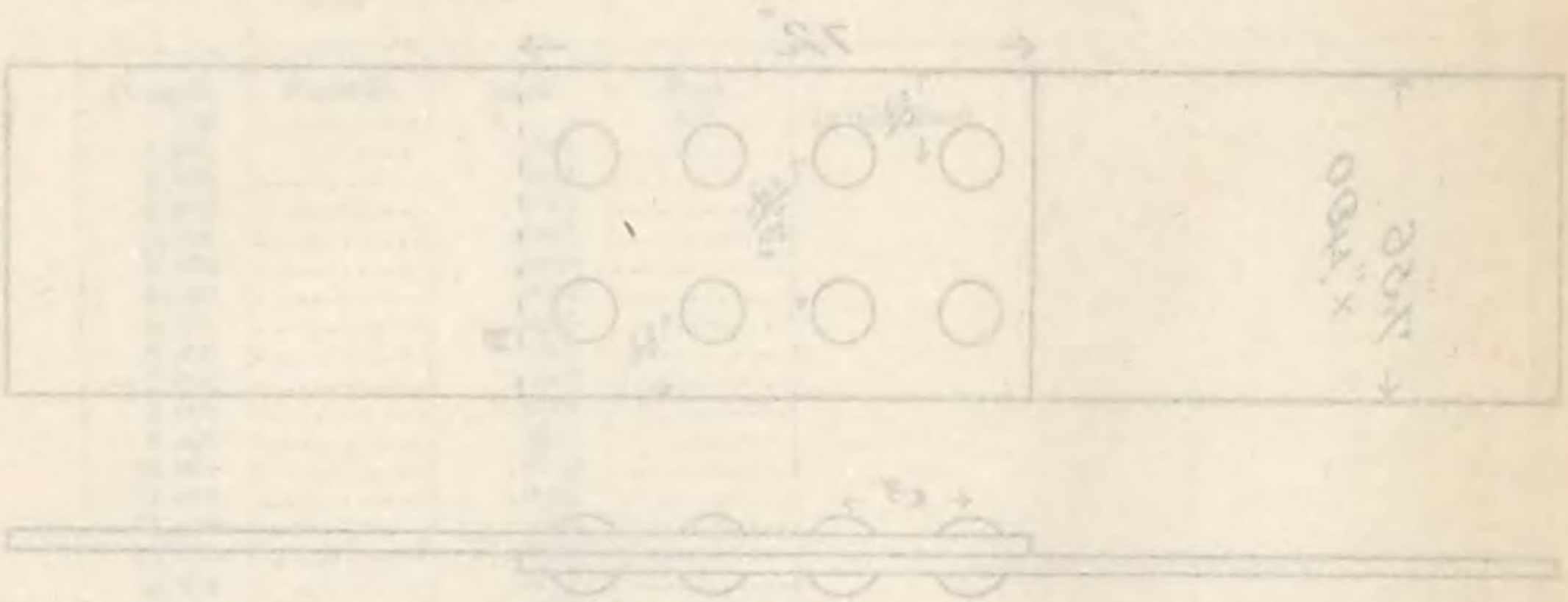
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0001	.....	
2,000	.....	.0001	.....	
2,500	.....	.0002	.....	
3,000	.....	.0003	.....	
4,000	.....	.0004	.....	
5,000	.....	.0005	.....	
6,000	.....	.0006	.....	
7,000	.....	.0008	.....	
8,000	.....	.0009	.....	
9,000	.....	.0011	.....	
10,000	.....	.0012	.....	
11,000	.....	.0014	.....	
12,000	.....	.0015	.....	
13,000	.....	.0016	.....	
14,000	.....	.0017	.....	
15,000	.....	.0018	.....	
16,000	.....	.0020	.....	
17,000	.....	.0021	.....	
18,000	.....	.0022	.....	
19,000	.....	.0023	.....	
20,000	.....	.0024	.0001	
21,000	.....	.0025	.....	
22,000	.....	.0026	.....	
23,000	.....	.0028	.....	
24,000	.....	.0029	.....	
25,000	.....	.0030	.....	
26,000	.....	.0031	.....	
27,000	.....	.0033	.....	
28,000	.....	.0034	.....	
29,000	.....	.0036	.....	
30,000	.....	.0036	.0001	
31,000	.....	.0038	.....	
32,000	.....	.0040	.....	
33,000	.....	.0041	.....	
34,000	.....	.0042	.....	
35,000	.....	.0044	.....	
36,000	.....	.0045	.....	
37,000	.....	.0046	.....	
38,000	.....	.0048	.....	
39,000	.....	.0050	.....	
40,000	.....	.0051	.0001	
41,000	.....	.0053	.....	
42,000	.....	.0055	.....	
43,000	.....	.0056	.....	
44,000	.....	.0058	.....	
45,000	.....	.0060	.....	
46,000	.....	.0061	.....	
47,000	.....	.0063	.....	
48,000	.....	.0065	.....	
49,000	.....	.0066	.....	
50,000	.....	.0067	.0004	
51,000	.....	.0070	.....	
52,000	.....	.0072	.....	
53,000	.....	.0074	.....	
54,000	.....	.0076	.....	
55,000	.....	.0078	.....	
56,000	.....	.0080	.....	
57,000	.....	.0082	.....	
58,000	.....	.0085	.....	
59,000	.....	.0087	.....	
60,000	.....	.0090	.0012	
61,000	.....	.0094	.....	
62,000	.....	.0096	.....	

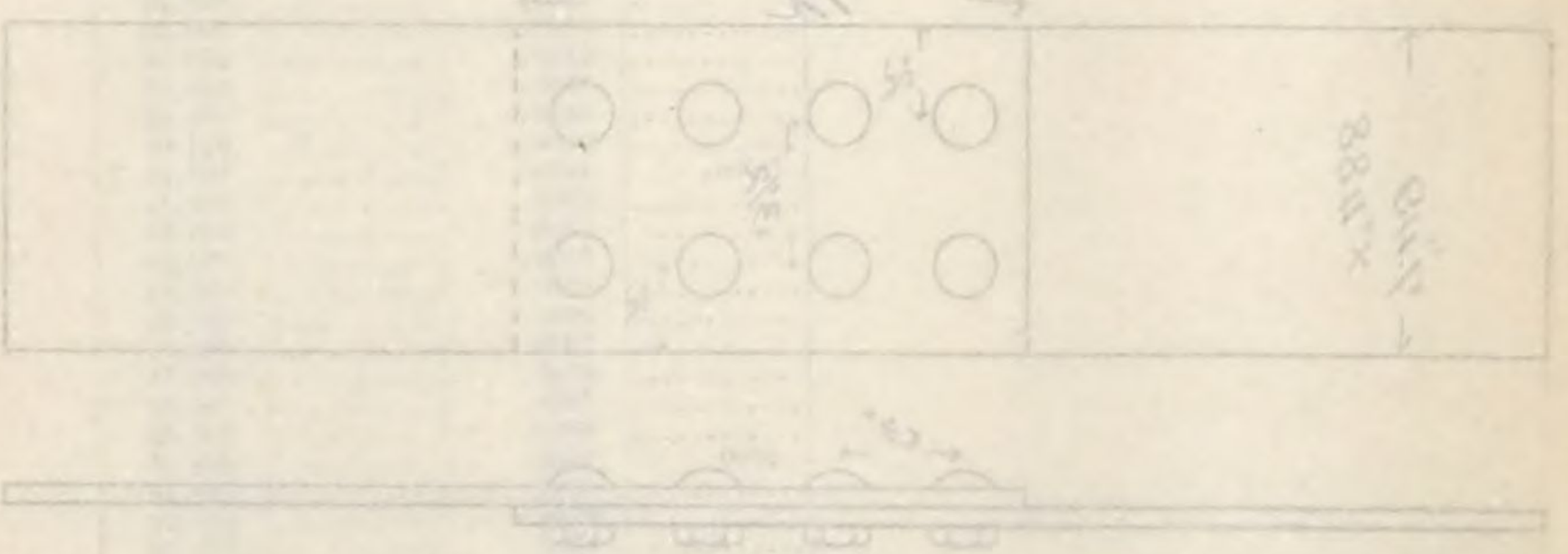
No. 9384.



No. 9385.







No. 9384—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
63,000	.....	.0100	.....	
64,000	.....	.0105	.....	
65,000	.....	.0111	.....	
66,000	.....	.0115	.....	
67,000	.....	.0120	.....	
68,000	.....	.0125	.....	
69,000	.....	.0130	.....	
70,000	.....	.0134	.0040	
71,000	.....	.0142	.....	
72,000	.....	.0145	.....	
73,000	.....	.0148	.....	
74,000	.....	.0151	.....	
75,000	.....	.0155	.....	
76,000	.....	.0159	.....	
77,000	.....	.0162	.....	
78,000	.....	.0166	.....	
79,000	.....	.0170	.....	
80,000	.....	.0174	.0061	
81,000	.....	.0180	.....	
82,000	.....	.0183	.....	
83,000	.....	.0186	.....	
84,000	.....	.0190	.....	
85,000	.....	.0193	.....	
86,000	.....	.0196	.....	
87,000	.....	.0201	.....	
88,000	.....	.0205	.....	
89,000	.....	.0210	.....	
90,000	.....	.0215	.0082	
91,000	.....	.0225	.....	
92,000	.....	.0232	.....	
93,000	.....	.0241	.....	
94,000	.....	.0249	.....	
95,000	.....	.03	.....	
98,000	.....	.03+	.....	
100,000	.....	.03+	.....	
110,000	.....	.04	.....	
120,000	.....	.08	.....	
127,100	34,350	.....	.....	Tensile strength.

Fractured plate across first row of rivet holes. Granular.

Maximum stress on joint.

Tension on gross section of plate	pounds per square inch..	34,350
Tension on net section of plate	do....	42,370

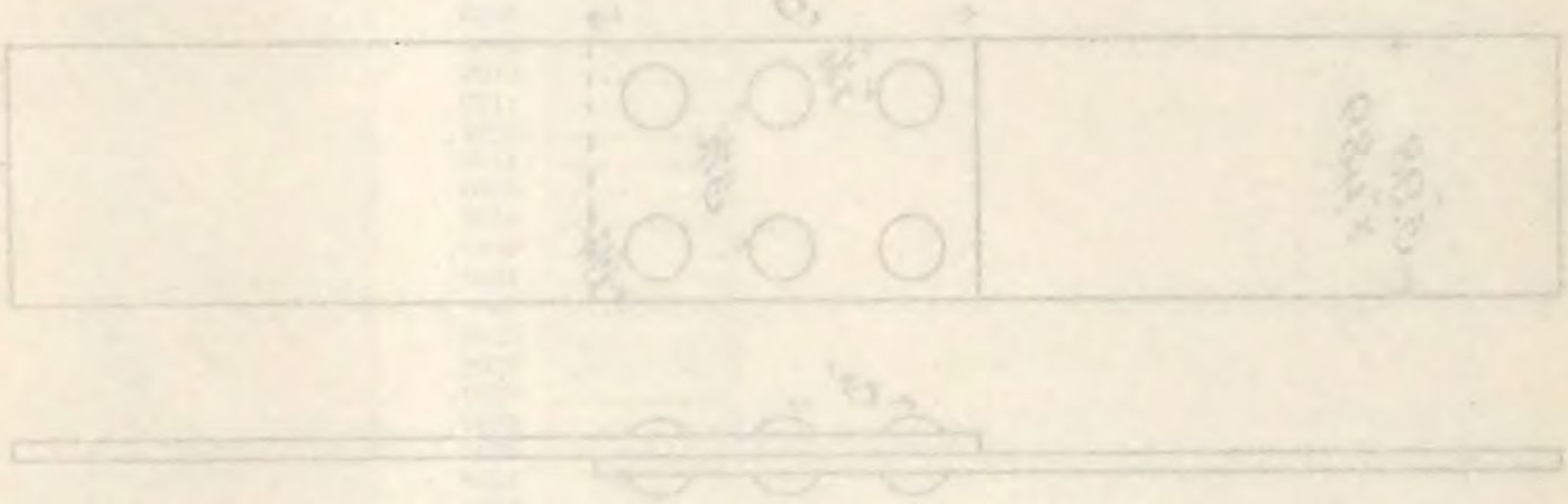
No. 9385.

Marks, T 14.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

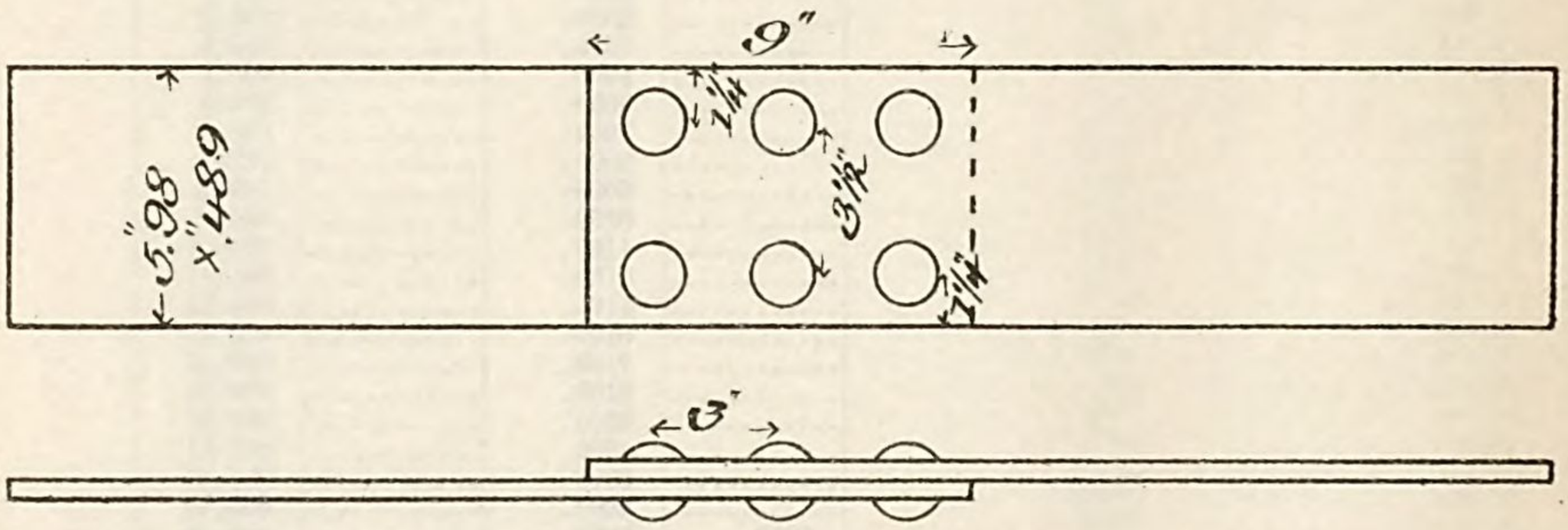
Gross sectional area of plate, 7".49 × ".488.....square inches.. 3.65
Shearing area of bolts, ".61 diameter.....do.... 2.34

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0001	.....	
2,000	.....	.0002	.....	
2,500	.....	.0002	.....	
3,000	.....	.0003	.....	
4,000	.....	.0004	.....	
5,000	.....	.0006	.....	
6,000	.....	.0007	.....	
7,000	.....	.0008	.....	
8,000	.....	.0009	.....	
9,000	.....	.0010	.....	
10,000	.....	.0011	.....	
11,000	.....	.0012	.....	
12,000	.....	.0014	.....	
13,000	.....	.0016	.....	
14,000	.....	.0017	.....	
15,000	.....	.0019	.....	
16,000	.....	.0020	.....	
17,000	.....	.0021	.....	
18,000	.....	.0023	.....	
19,000	.....	.0025	.....	
20,000	.....	.0027	.0003	
21,000	.....	.0029	.....	
22,000	.....	.0031	.....	
23,000	.....	.0033	.....	
24,000	.....	.0035	.....	
25,000	.....	.0040	.....	
26,000	.....	.0051	.....	
27,000	.....	.03	.....	
30,000	.....	.14	.....	
36,000	.....	.16	.....	
40,000	.....	.17	.....	
44,000	.....	.17+	.....	
48,000	.....	.17+	.....	
54,000	.....	.19	.....	
58,000	.....	.20	.....	
64,000	.....	.22	.....	
68,000	.....	.23	.....	
72,000	.....	.24	.....	
76,000	.....	.26	.....	
80,000	.....	.27	.....	
81,800	22,410	.....	.....	Tensile strength.
	34,960	.....	.....	Shearing strength of bolts.

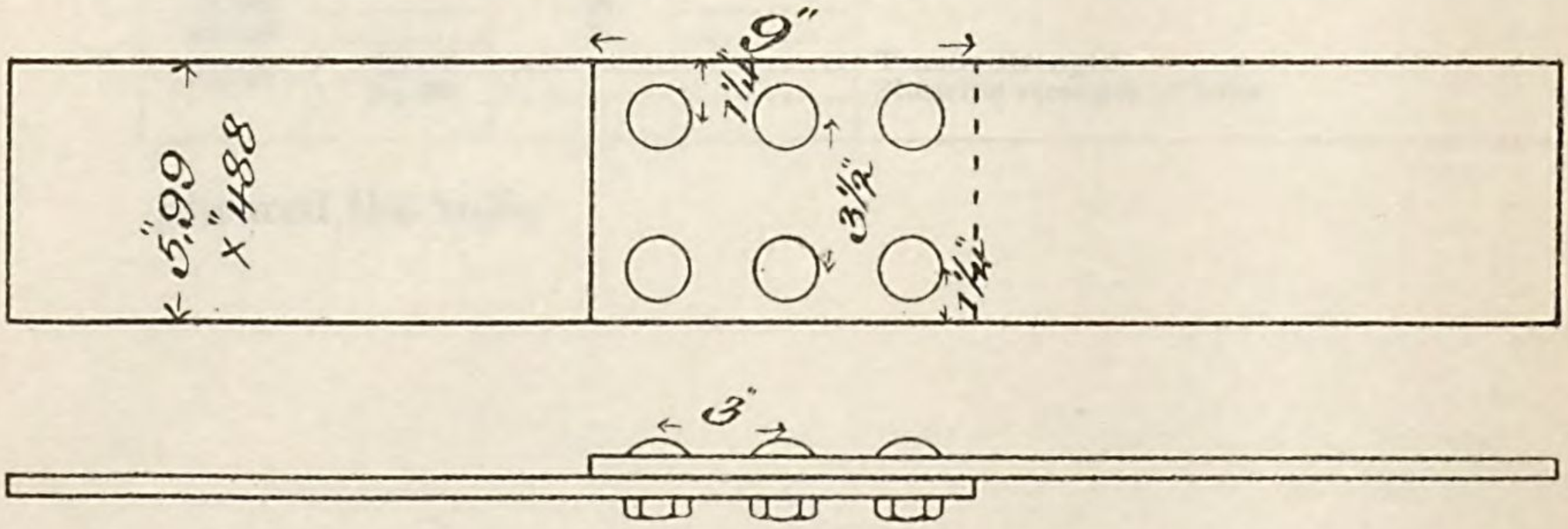
Sheared the bolts.



No. 9386.



No. 9387.



No. 9386.

Marks, T 5.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of plate, $5''.98 \times ''.489 = 2.92$ square inches.
Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0002	.....	
1,500	.....	.0003	.....	
2,000	.....	.0004	.....	
2,500	.....	.0004	.....	
3,000	.....	.0005	.....	
4,000	.....	.0006	.....	
5,000	.....	.0008	.....	
6,000	.....	.0010	.....	
7,000	.....	.0011	.....	
8,000	.....	.0012	.....	
9,000	.....	.0014	.....	
10,000	.....	.0015	.....	
11,000	.....	.0018	.....	
12,000	.....	.0019	.....	
13,000	.....	.0021	.....	
14,000	.....	.0024	.....	
15,000	.....	.0026	.....	
16,000	.....	.0028	.....	
17,000	.....	.0030	.....	
18,000	.....	.0032	.....	
19,000	.....	.0033	.....	
20,000	.....	.0034	0.	
21,000	.....	.0036	.....	
22,000	.....	.0038	.....	
23,000	.....	.0040	.....	
24,000	.....	.0042	.....	
25,000	.....	.0044	.....	
26,000	.....	.0047	.....	
27,000	.....	.0049	.....	
28,000	.....	.0051	.....	
29,000	.....	.0054	.....	
30,000	.....	.0055	.0002	
31,000	.....	.0057	.....	
32,000	.....	.0059	.....	
33,000	.....	.0061	.....	
34,000	.....	.0063	.....	
35,000	.....	.0065	.....	
36,000	.....	.0067	.....	
37,000	.....	.0070	.....	
38,000	.....	.0072	.....	
39,000	.....	.0075	.....	
40,000	.....	.0077	.0003	
41,000	.....	.0083	.....	
42,000	.....	.0085	.....	
43,000	.....	.0087	.....	
44,000	.....	.0089	.....	
45,000	.....	.0091	.....	
46,000	.....	.0094	.....	
47,000	.....	.0096	.....	
48,000	.....	.0099	.....	
49,000	.....	.0101	.....	
50,000	.....	.0104	.0005	
51,000	.....	.0108	.....	
52,000	.....	.0113	.....	
53,000	.....	.0115	.....	
54,000	.....	.0119	.....	
55,000	.....	.0125	.....	
56,000	.....	.0133	.....	
57,000	.....	.0139	.....	
58,000	.....	.0145	.....	
59,000	.....	.0154	.....	
60,000	.....	.0163	.0045	Rested 16 hours.
61,000	.....	.0164	.....	
62,000	.....	.0166	.....	
63,000	.....	.0171	.....	
64,000	.....	.0189	.....	

No. 9386—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
65,000	.....	.0202	.....	
66,000	.....	.0211	.....	
67,000	.....	.0220	.....	
68,000	.....	.0227	.....	
69,000	.....	.0237	.....	
70,000	.....	.0247	.0111	
71,000	.....	.0264	.....	
72,000	.....	.0269	.....	
73,000	.....	.0275	.....	
74,000	.....	.0286	.....	
75,000	.....	.0302	.....	
80,000	.....	.04	.....	
84,000	.....	.08	.....	
92,000	.....	.14	.....	
96,000	32,880	.....	.....	Tensile strength.

Sheared the rivets. Started a fracture at sides of rivet hole in first row.

No. 9387.

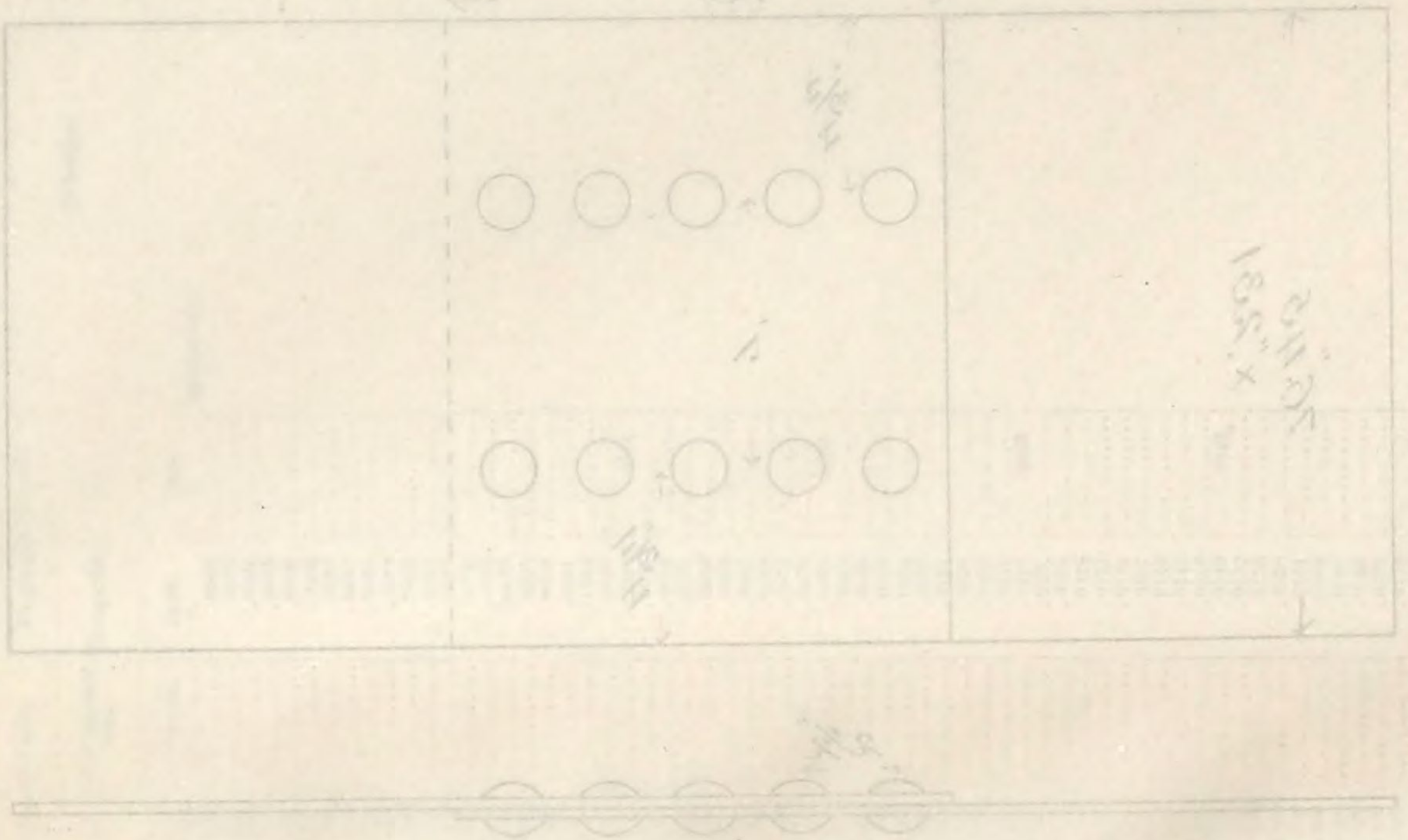
Marks, T 6.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, $5''.99 \times ''.488$ ..... square inches.. 2.92
Shearing area of bolts, ''.61 diameter ..... do 1.75

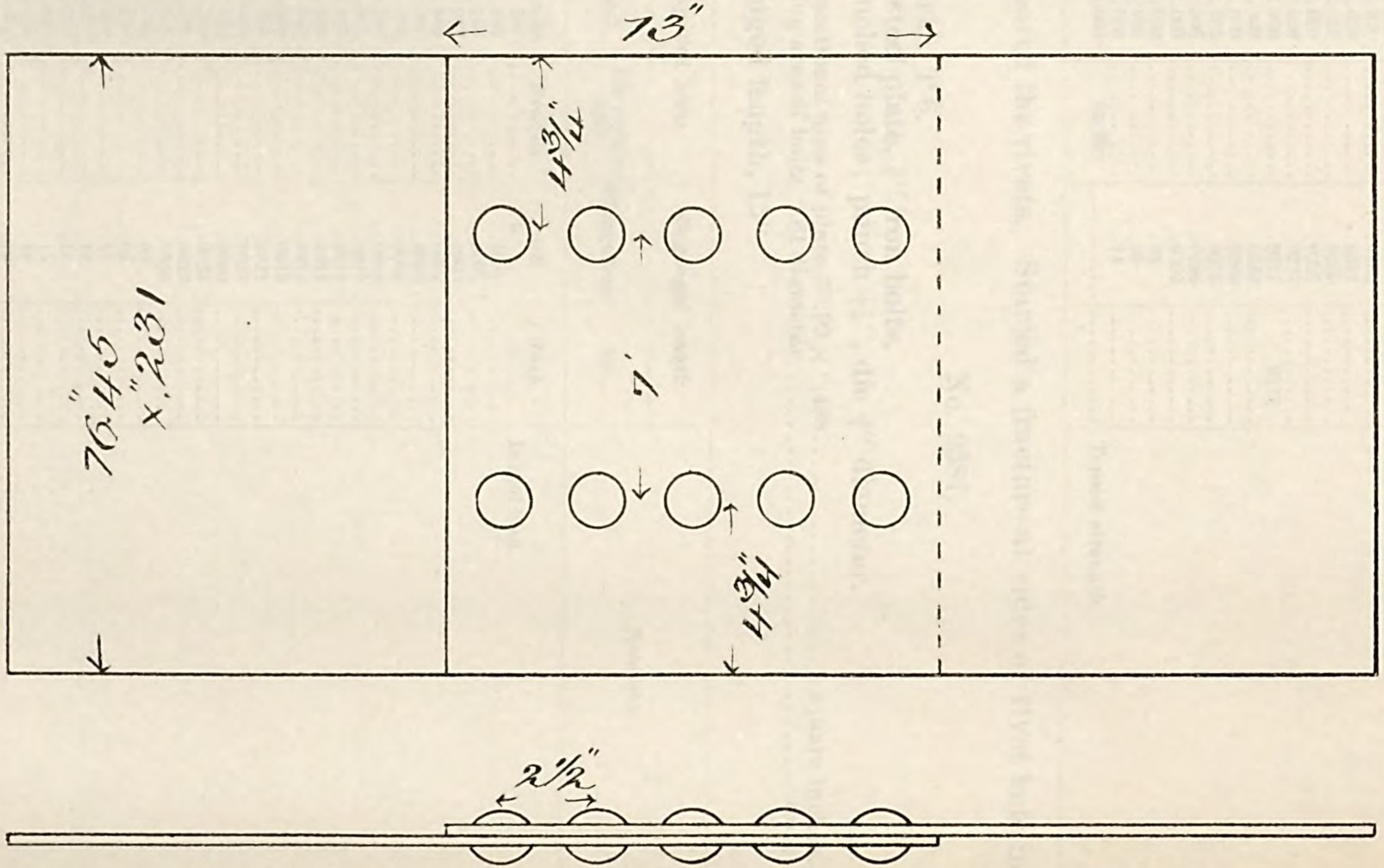
Gauged length, 15''.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0001	.....	
2,000	.....	.0003	.....	
2,500	.....	.0004	.....	
3,000	.....	.0005	.....	
4,000	.....	.0006	.....	
5,000	.....	.0008	.....	
6,000	.....	.0010	.....	
7,000	.....	.0012	.....	
8,000	.....	.0014	.....	
9,000	.....	.0016	.....	
10,000	.....	.0019	.....	
11,000	.....	.0021	.....	
12,000	.....	.0025	.....	
13,000	.....	.0029	.....	
14,000	.....	.0033	.....	
15,000	.....	.0039	.....	
16,000	.....	.0050	.....	
17,000	.....	.03	.....	
22,000	.....	.08	.....	
26,000	.....	.11	.....	
30,000	.....	.13	.....	
34,000	.....	.16	.....	
38,000	.....	.17	.....	
42,000	.....	.18	.....	
44,000	.....	.19	.....	
48,000	.....	.21	.....	
51,800	17,740	.....	.....	Tensile strength.
	29,600	.....	.....	Shearing strength of bolts.

Sheared the bolts.



No. 9388.



No. 9388.

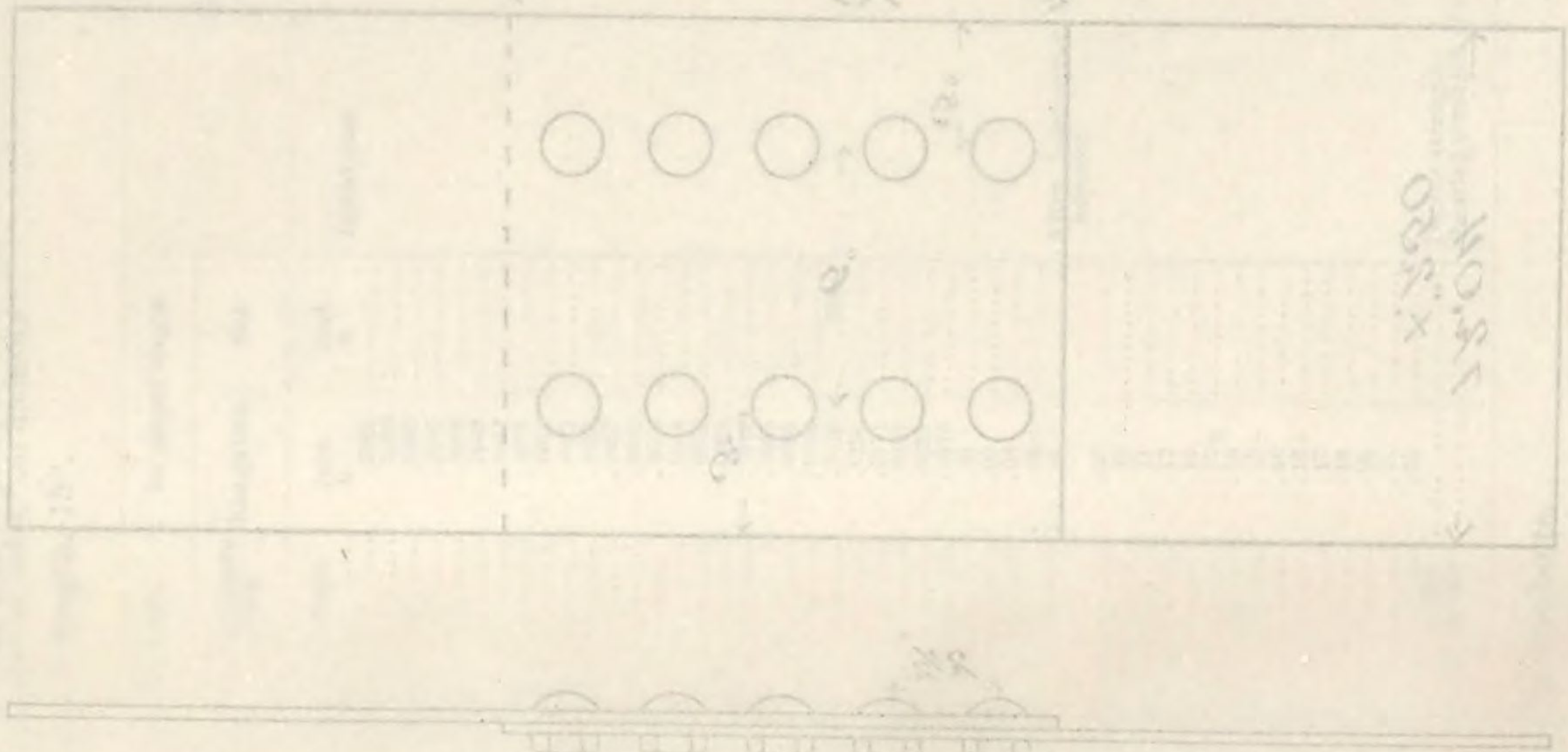
Marks, T 25.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of plate, $16''.45 \times ''.231 = 3.80$ square inches.
Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0003	.....	
2,000	.....	.0004	.....	
2,500	.....	.0005	.....	
3,000	.....	.0006	.....	
4,000	.....	.0008	.....	
5,000	.....	.0011	.....	
6,000	.....	.0013	.....	
7,000	.....	.0016	.....	
8,000	.....	.0019	.....	
9,000	.....	.0021	.....	
10,000	.....	.0024	.....	
11,000	.....	.0026	.....	
12,000	.....	.0029	.....	
13,000	.....	.0031	.....	
14,000	.....	.0033	.....	
15,000	.....	.0035	.....	
16,000	.....	.0038	.....	
17,000	.....	.0041	.....	
18,000	.....	.0044	.....	
19,000	.....	.0046	.....	
20,000	.....	.0048	.0004	
21,000	.....	.0051	.....	
22,000	.....	.0054	.....	
23,000	.....	.0057	.....	
24,000	.....	.0059	.....	
25,000	.....	.0062	.....	
26,000	.....	.0065	.....	
27,000	.....	.0069	.....	
28,000	.....	.0072	.....	
29,000	.....	.0075	.....	
30,000	.....	.0079	.0015	
31,000	.....	.0085	.....	
32,000	.....	.0089	.....	
33,000	.....	.0091	.....	
34,000	.....	.0094	.....	
35,000	.....	.0096	.....	
36,000	.....	.0101	.....	
37,000	.....	.0104	.....	
38,000	.....	.0108	.....	
39,000	.....	.0112	.....	
40,000	.....	.0115	.0033	
41,000	.....	.0121	.....	
42,000	.....	.0124	.....	
43,000	.....	.0128	.....	
44,000	.....	.0131	.....	
45,000	.....	.0134	.....	
46,000	.....	.0137	.....	
47,000	.....	.0140	.....	
48,000	.....	.0143	.....	
49,000	.....	.0146	.....	
50,000	.....	.0149	.0049	
51,000	.....	.0152	.....	
52,000	.....	0155	.....	
53,000	.....	.0158	.....	
54,000	.....	.0161	.....	
55,000	.....	.0163	.....	
56,000	.....	.0166	.....	
57,000	.....	.0169	.....	
58,000	.....	.0171	.....	
59,000	.....	.0175	.....	
60,000	.....	.0177	.0062	
61,000	.....	.0181	.....	
62,000	.....	.0184	.....	
63,000	.....	.0186	.....	
64,000	.....	.0189	.....	

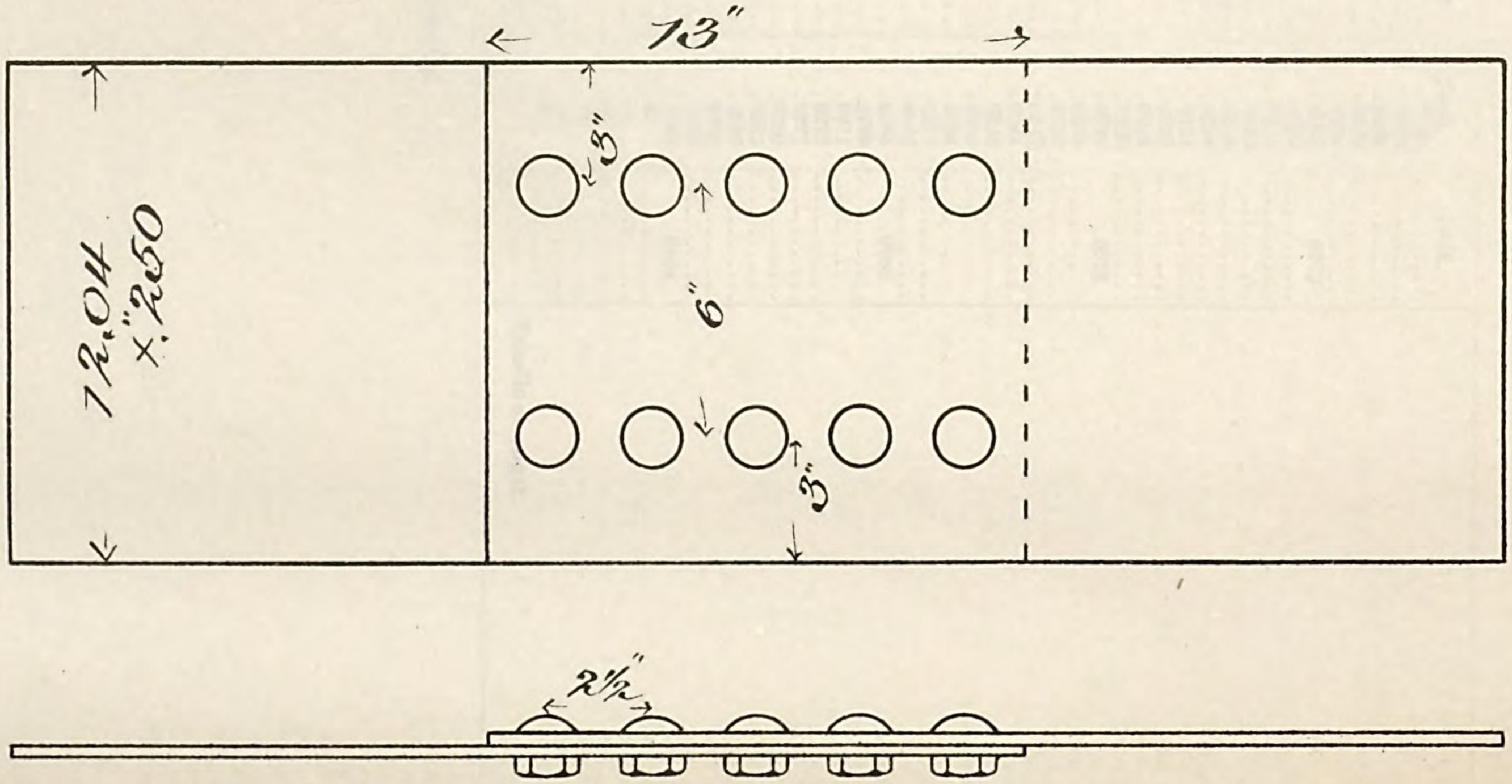
No. 9388—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
65, 000	.....	.0191	.....	
66, 000	.....	.0194	.....	
67, 000	.....	.0196	.....	
68, 000	.....	.0200	.....	
69, 000	.....	.0203	.....	
70, 000	.....	.0205	.0072	
71, 000	.....	.0210	.....	
72, 000	.....	.0212	.....	
73, 000	.....	.0215	.....	
74, 000	.....	.0216	.....	
75, 000	.....	.0218	.....	
76, 000	.....	.0221	.....	
77, 000	.....	.0223	.....	
78, 000	.....	.0226	.....	
79, 000	.....	.0228	.....	
80, 000	.....	.0230	.0079	
81, 000	.....	.0235	.....	
82, 000	.....	.0239	.....	
83, 000	.....	.0242	.....	
84, 000	.....	.0244	.....	
85, 000	.....	.0246	.....	
86, 000	.....	.0250	.....	
87, 000	.....	.0254	.....	
88, 000	.....	.0257	.....	
89, 000	.....	.0260	.....	
90, 000	.....	.0264	.0092	
91, 000	.....	.0269	.....	
92, 000	.....	.0271	.....	
93, 000	.....	.0275	.....	
94, 000	.....	.0277	.....	
95, 000	.....	.0280	.....	
96, 000	.....	.0283	.....	
97, 000	.....	.0286	.....	
98, 000	.....	.0290	.....	
99, 000	.....	.0293	.....	
100, 000	.....	.0295	0104	
110, 000	.....	.03	.....	
120, 000	.....	.04	.....	
130, 000	.....	.06	.....	
140, 000	.....	.07	.....	
150, 000	.....	.11	.....	
160, 000	.....	.22	.....	
169, 700	44, 660	.....	.....	Tensile strength.

Sheared the rivets.



No. 9389.



No. 9389.

Marks, T 26.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, 12″.04×″.250 ..... square inches.. 3.01
Shearing area of bolts, ″.61 diameter ..... do.... 2.92

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0002	.....	
2,000	.....	.0003	.....	
2,500	.....	.0005	.....	
3,000	.....	.0006	.....	
4,000	.....	.0009	.....	
5,000	.....	.0012	.....	
6,000	.....	.0015	.....	
7,000	.....	.0017	.....	
8,000	.....	.0021	.....	
9,000	.....	.0023	.....	
10,000	.....	.0027	.....	
11,000	.....	.0031	.....	
12,000	.....	.0040	.....	
13,000	.....	.0048	.....	
14,000	.....	.0056	.....	
15,000	.....	.0065	.....	
16,000	.....	.0076	.....	
17,000	.....	.0085	.....	
18,000	.....	.0095	.....	
19,000	.....	.0109	.....	
20,000	.....	.0126	.0089	
21,000	.....	.0150	.....	
22,000	.....	.0171	.....	
23,000	.....	.0197	.....	
24,000	.....	.0235	.....	
25,000	.....	.0275	.....	
26,000	.....	.03	.....	
30,000	.....	.05	.....	
34,000	.....	.06	.....	
38,000	.....	.08	.....	
	.....	.09	.....	After hammering lightly with a 2¼-pound hammer.
42,000	.....	.10	.....	
46,000	.....	.10	.....	
50,000	.....	.11	.....	
54,000	.....	.12	.....	
58,000	.....	.13	.....	
62,000	.....	.13+	.....	
66,000	.....	.15	.....	
70,000	.....	.15+	.....	
74,000	.....	.16	.....	
78,000	.....	.16+	.....	
82,000	.....	.17	.....	
86,000	.....	.19	.....	
90,000	.....	.20	.....	
94,000	.....	.21	.....	
100,000	.....	.25	.....	
105,200	34,950	.....	.....	Tensile strength.
	36,030	.....	.....	Shearing strength of bolts.

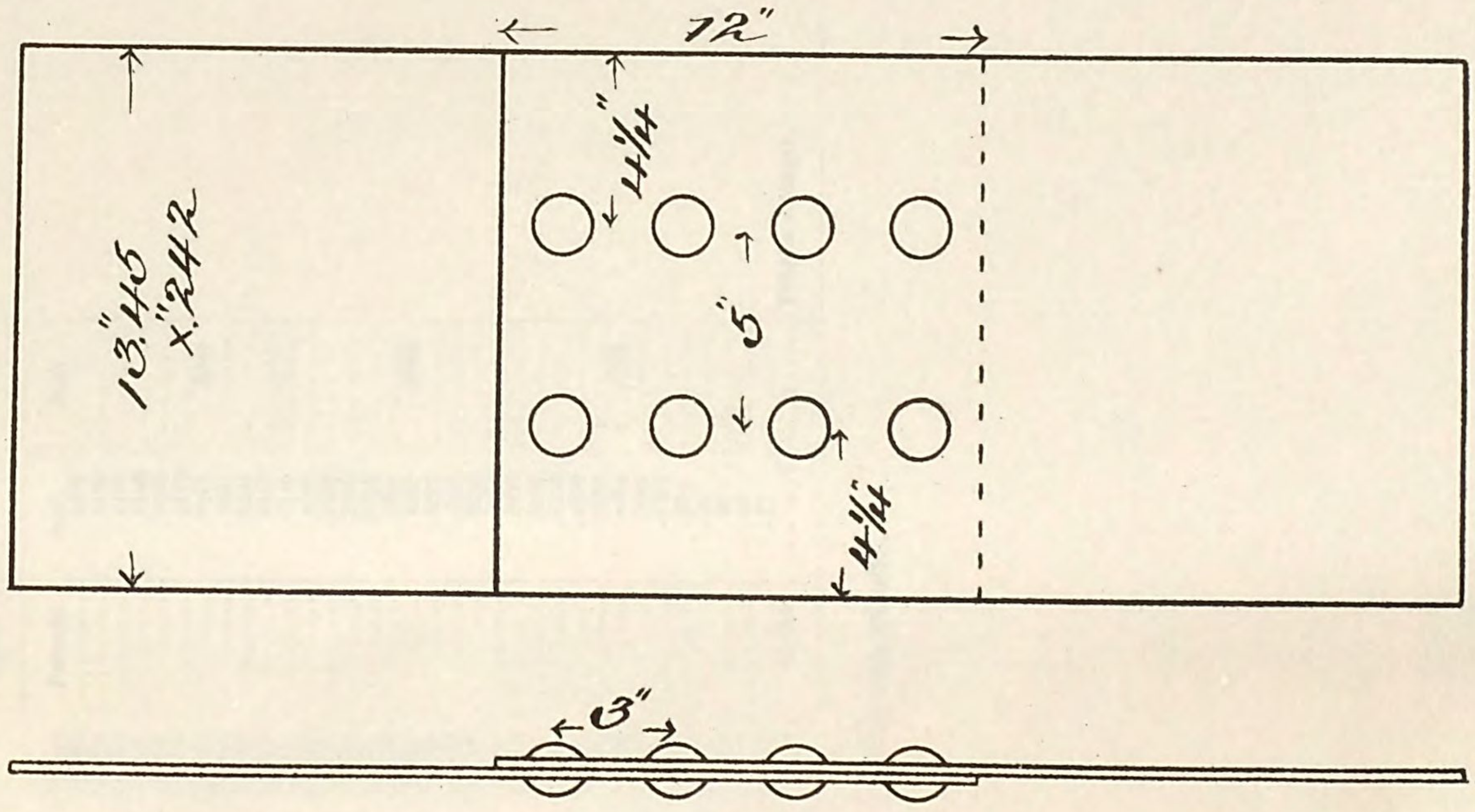
Sheared the bolts.

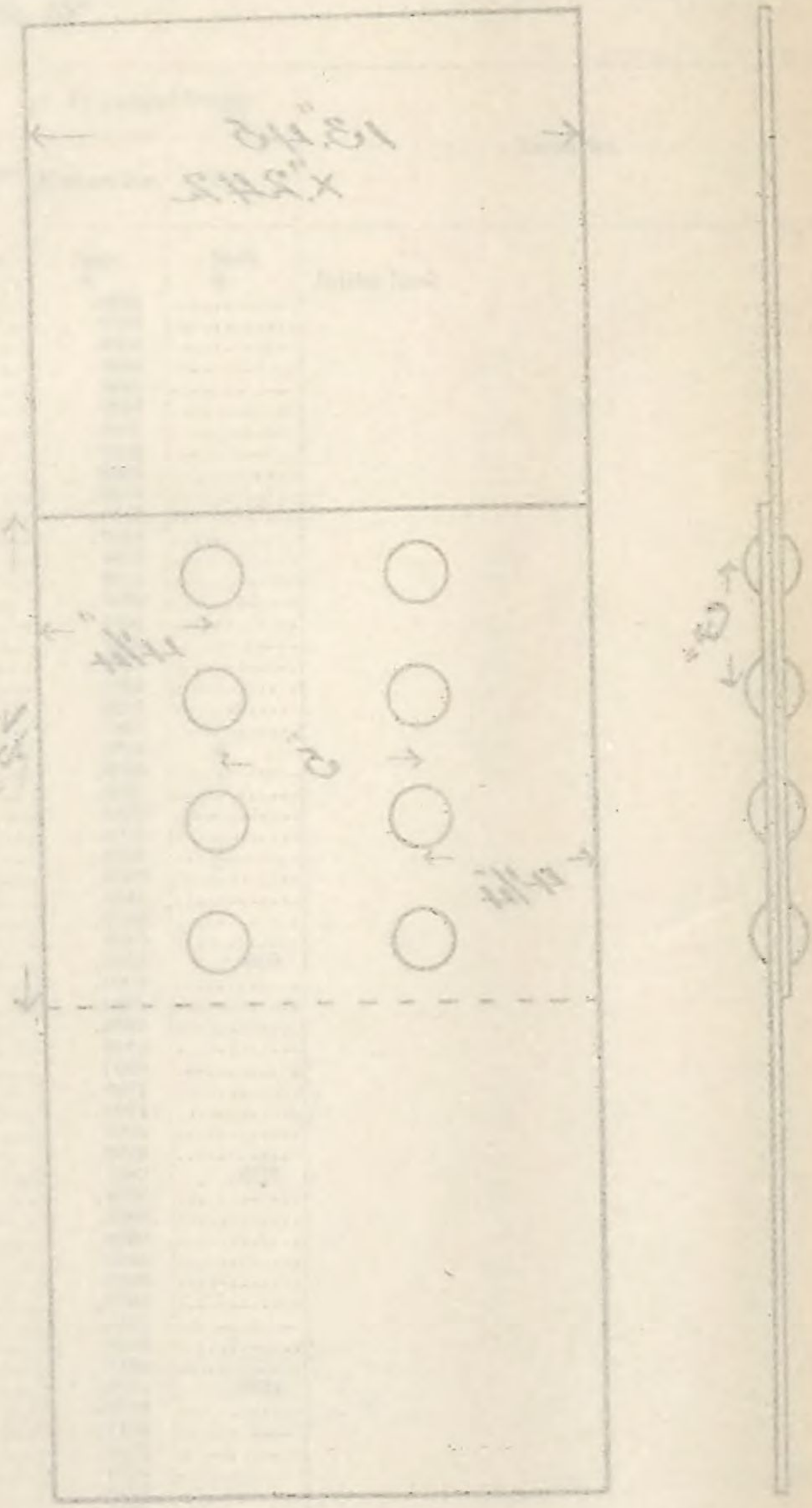
No. 9390.

Marks, T 17.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of plate, $13''.45 \times ''.242 = 3.25$ square inches.
Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0002	.....	
2,000	.....	.0003	.....	
2,500	.....	.0004	.....	
3,000	.....	.0005	.....	
4,000	.....	.0006	.....	
5,000	.....	.0007	.....	
6,000	.....	.0008	.....	
7,000	.....	.0009	.....	
8,000	.....	.0010	.....	
9,000	.....	.0012	.....	
10,000	.....	.0014	.....	
11,000	.....	.0016	.....	
12,000	.....	.0018	.....	
13,000	.....	.0020	.....	
14,000	.....	.0021	.....	
15,000	.....	.0024	.....	
16,000	.....	.0025	.....	
17,000	.....	.0028	.....	
18,000	.....	.0030	.....	
19,000	.....	.0031	.....	
20,000	.....	.0034	0.	
21,000	.....	.0036	.....	
22,000	.....	.0037	.....	
23,000	.....	.0039	.....	
24,000	.....	.0041	.....	
25,000	.....	.0043	.....	
26,000	.....	.0046	.....	
27,000	.....	.0948	.....	
28,000	.....	.0050	.....	
29,000	.....	.0052	.....	
30,000	.....	.0055	.0005	
31,000	.....	.0058	.....	
32,000	.....	.0061	.....	
33,000	.....	.0063	.....	
34,000	.....	.0066	.....	
35,000	.....	.0069	.....	
36,000	.....	.0071	.....	
37,000	.....	.0074	.....	
38,000	.....	.0076	.....	
39,000	.....	.0079	.....	
40,000	.....	.0082	.0016	
41,000	.....	.0086	.....	
42,000	.....	.0088	.....	
43,000	.....	.0090	.....	
44,000	.....	.0093	.....	
45,000	.....	.0096	.....	
46,000	.....	.0098	.....	
47,000	.....	.0102	.....	
48,000	.....	.0106	.....	
49,000	.....	.0109	.....	
50,000	.....	.0111	.0024	
51,000	.....	.0116	.....	
52,000	.....	.0119	.....	
53,000	.....	.0121	.....	
54,000	.....	.0124	.....	
55,000	.....	.0128	.....	
56,000	.....	.0130	.....	
57,000	.....	.0133	.....	
58,000	.....	.0136	.....	
59,000	.....	.0139	.....	
60,000	.....	.0142	.0039	
61,000	.....	.0149	.....	
62,000	.....	.0152	.....	
63,000	.....	.0154	.....	

No. 9390.





No. 9390—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
64,000	.....	.0157	.....	
65,000	.....	.0160	.....	
66,000	.....	.0163	.....	
67,000	.....	.0166	.....	
68,000	.....	.0169	.....	
69,000	.....	.0172	.....	
70,000	.....	.0175	.0049	
71,000	.....	.0181	.....	
72,000	.....	.0184	.....	
73,000	.....	.0187	.....	
74,000	.....	.0190	.....	
75,000	.....	.0193	.....	
76,000	.....	.0196	.....	
77,000	.....	.0199	.....	
78,000	.....	.0202	.....	
79,000	.....	.0204	.....	
80,000	.....	.0208	.0080	
81,000	.....	.0212	.....	
82,000	.....	.0215	.....	
83,000	.....	.0220	.....	
84,000	.....	.0225	.....	
85,000	.....	.0229	.....	
86,000	.....	.0236	.....	
87,000	.....	.0243	.....	
88,000	.....	.0249	.....	
89,000	.....	.0255	.....	
90,000	.....	.0268	.0124	
91,000	.....	.0280	.....	
92,000	.....	.0310	.....	
94,900	.....	.03+	.....	
100,000	.....	.04	.....	
110,000	.....	.06	.....	
120,000	.....	.08	.....	
130,000	.....	.11	.....	
138,800	42,710	.....	.....	Tensile strength.

Sheared the rivets.

No. 9391.

Marks, T 18.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

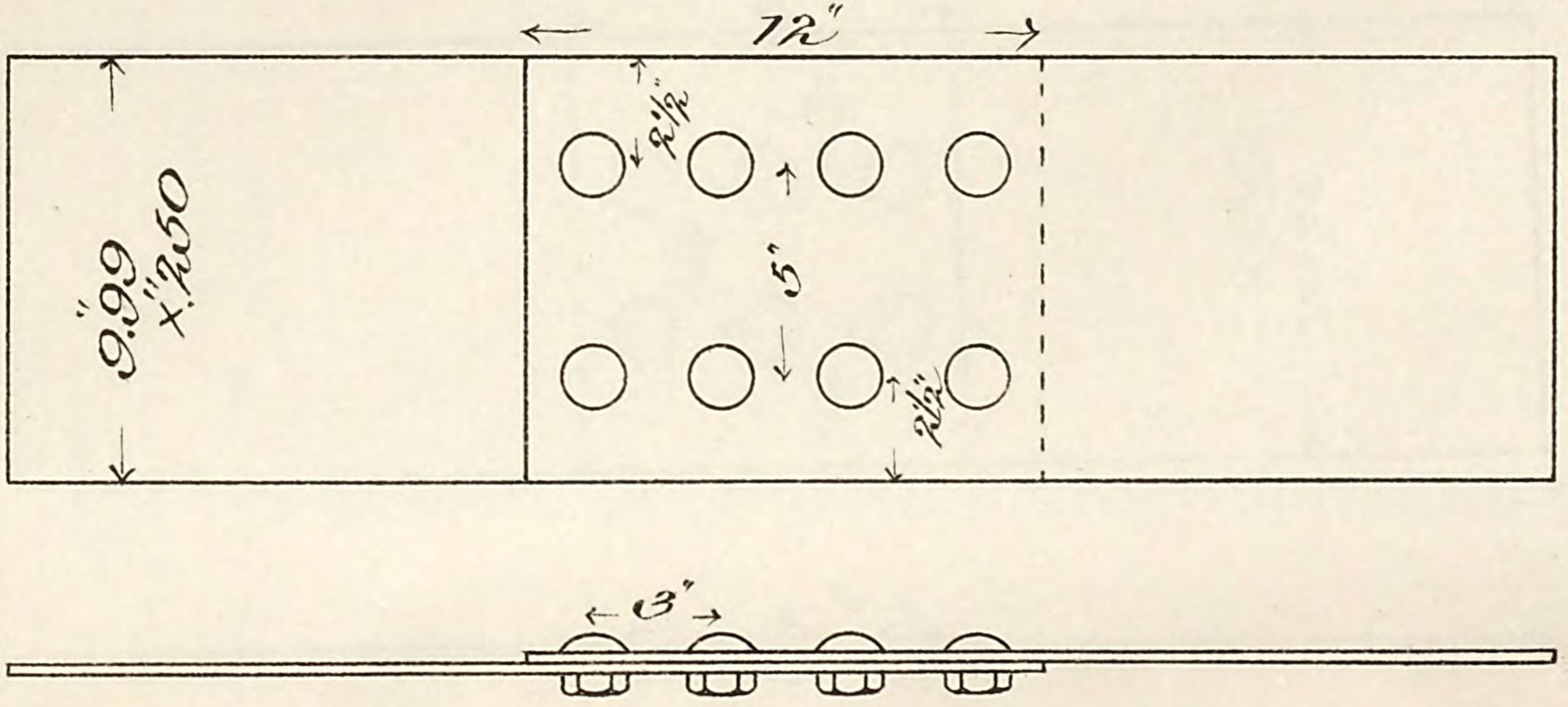
Gross sectional area of plate, 9''.99 × ''.250.....square inches.. 2.50
Shearing area of bolts, ''.61 diameter.....do.... 2.34

Gauged length, 15''.

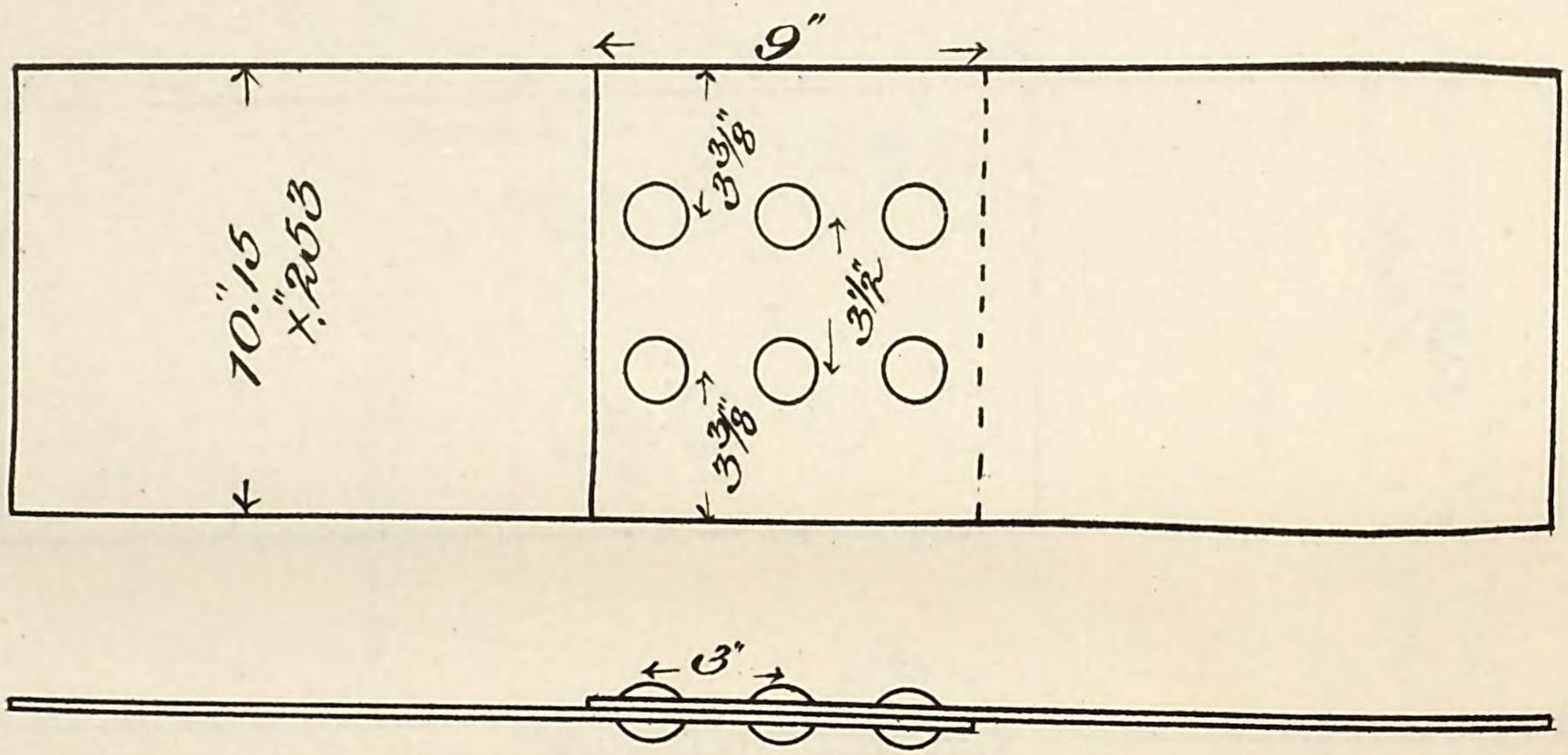
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0002	.....	
2,000	.....	.0003	.....	
2,500	.....	.0004	.....	
3,000	.....	.0005	.....	
4,000	.....	.0006	.....	
5,000	.....	.0007	.....	
6,000	.....	.0009	.....	
7,000	.....	.0011	.....	
8,000	.....	.0013	.....	
9,000	.....	.0015	.....	
10,000	.....	.0017	.....	
11,000	.....	.0019	.....	
12,000	.....	.0021	.....	
13,000	.....	.0024	.....	
14,000	.....	.0026	.....	
15,000	.....	.0028	.....	
16,000	.....	.0030	.....	
17,000	.....	.0034	.....	
18,000	.....	.0036	.....	
19,000	.....	.0040	.....	
20,000	.....	.0048	.0011	
21,000	.....	.11	.....	
24,000	.....	.12	.....	
28,000	.....	.14	.....	
32,000	.....	.15	.....	
36,000	.....	.16	.....	
40,000	.....	.17	.....	
44,000	.....	.17	.....	
48,000	.....	.18	.....	
52,000	.....	.19	.....	
56,000	.....	.20	.....	
60,000	.....	.21	.....	
64,000	.....	.22	.....	
68,000	.....	.23	.....	
72,000	.....	.25	.....	
76,000	.....	.26	.....	
80,000	.....	.28	.....	
84,000	.....	.30	.....	
87,100	34,840	.....	.....	Tensile strength.
	37,220	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9391.



No. 9392.



No. 9392.

Marks, T 9.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of plate, $10''.15 \times ''.253 = 2.57$ square inches.
Gauged length, $15''$.

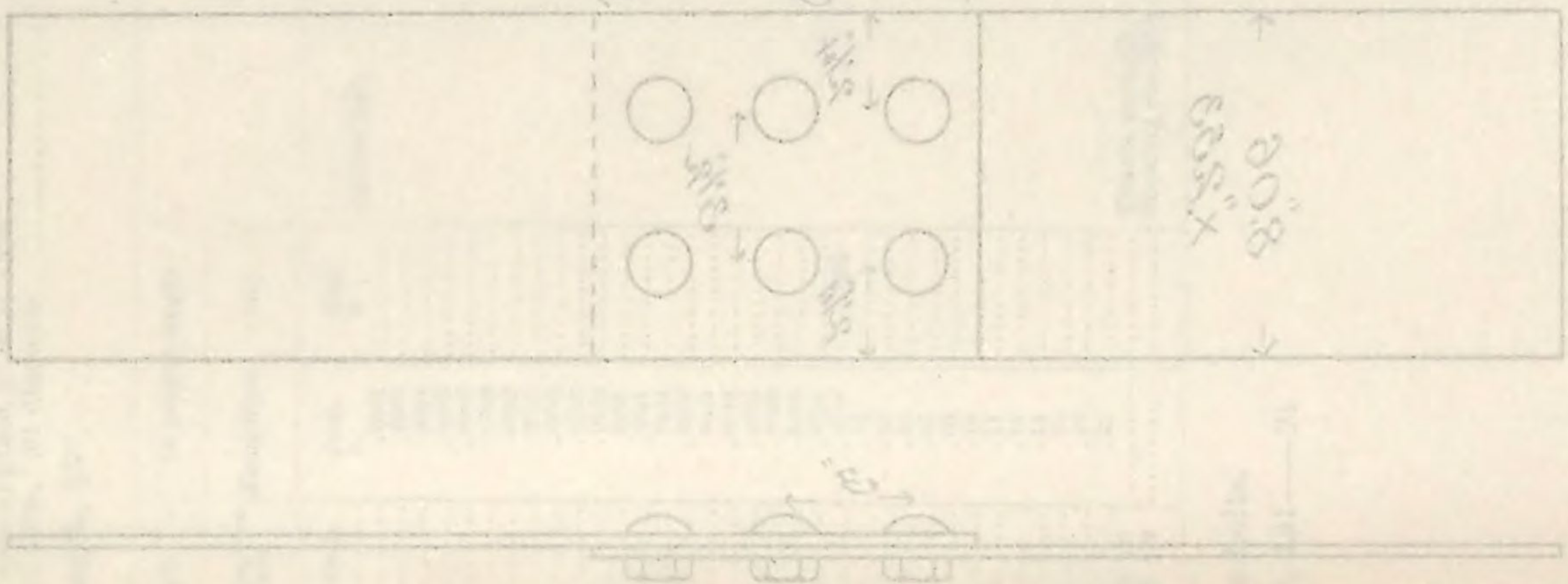
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0003	.....	
2,000	.....	.0003	.....	
2,500	.....	.0005	.....	
3,000	.....	.0006	.....	
4,000	.....	.0008	.....	
5,000	.....	.0010	.....	
6,000	.....	.0013	.....	
7,000	.....	.0015	.....	
8,000	.....	.0017	.....	
9,000	.....	.0020	.....	
10,000	.....	.0023	.....	
11,000	.....	.0026	.....	
12,000	.....	.0029	.....	
13,000	.....	.0032	.....	
14,000	.....	.0034	.....	
15,000	.....	.0037	.....	
16,000	.....	.0040	.....	
17,000	.....	.0042	.....	
18,000	.....	.0045	.....	
19,000	.....	.0048	.....	
20,000	.....	.0050	.0007	
21,000	.....	.0053	.....	
22,000	.....	.0056	.....	
23,000	.....	.0060	.....	
24,000	.....	.0064	.....	
25,000	.....	.0067	.....	
26,000	.....	.0071	.....	
27,000	.....	.0075	.....	
28,000	.....	.0079	.....	
29,000	.....	.0083	.....	
30,000	.....	.0088	.0022	
31,000	.....	.0093	.....	
32,000	.....	.0097	.....	
33,000	.....	.0102	.....	
34,000	.....	.0108	.....	
35,000	.....	.0112	.....	
36,000	.....	.0117	.....	
37,000	.....	.0121	.....	
38,000	.....	.0126	.....	
39,000	.....	.0131	.....	
40,000	.....	.0135	.0046	
41,000	.....	.0142	.....	
42,000	.....	.0146	.....	
43,000	.....	.0150	.....	
44,000	.....	.0155	.....	
45,000	.....	.0160	.....	
46,000	.....	.0163	.....	
47,000	.....	.0168	.....	
48,000	.....	.0172	.....	
49,000	.....	.0177	.....	
50,000	.....	.0182	.....	
51,000	.....	.0189	.....	
52,000	.....	.0193	.....	
53,000	.....	.0197	.....	
54,000	.....	.0201	.....	
55,000	.....	.0206	.....	
56,000	.....	.0210	.....	
57,000	.....	.0215	.....	
58,000	.....	.0217	.....	
59,000	.....	.0223	.....	
60,000	.....	.0227	.....	
61,000	.....	.0236	.....	
62,000	.....	.0240	.....	
63,000	.....	.0244	.....	
64,000	.....	.0249	.....	

No. 9392—Continued.

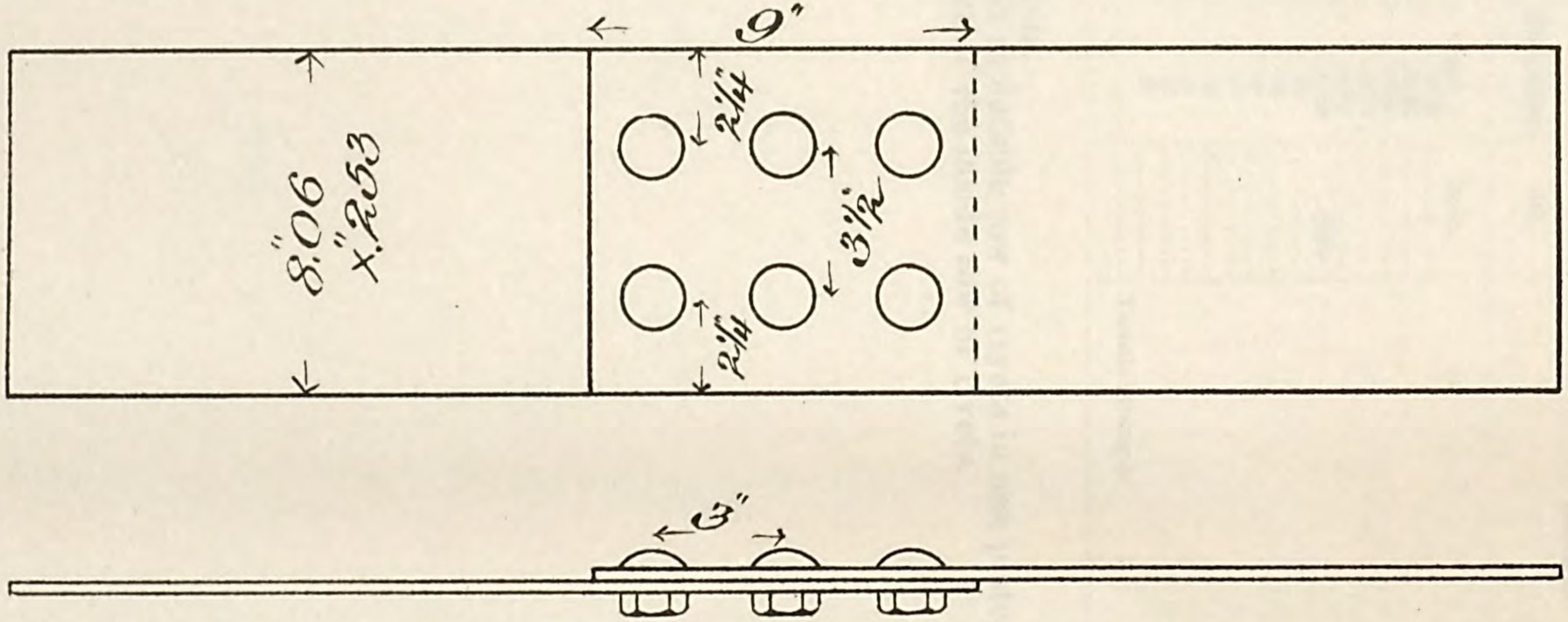
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
65,000	.....	.0255	.....	
66,000	.....	.0262	.....	
67,000	.....	.0268	.....	
68,000	.....	.0273	.....	
69,000	.....	.0281	.....	
70,000	.....	.0289	.0128	
72,000	.....	.03	.....	
76,000	.....	.04	.....	
80,000	.....	.06	.....	
84,000	.....	.07	.....	
88,000	.....	.08	.....	
92,000	.....	.10	.....	
96,000	.....	.17	.....	
100,000	.....	.37	.....	
105,900	41,210	.....	.....	Tensile strength.

Sheared the rivets.

Fracture started at outside row of rivets in one plate, and at end of same plate in front of the inside row of rivets.



No. 9393.



No. 9393.

Marks, T 10.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate, 8″.06 × ″.253 ..... square inches.. 2.04
Shearing area of bolts, ″.61 diameter ..... do.... 1.75

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
1,500	.....	.0003	.....	
2,000	.....	.0004	.....	
2,500	.....	.0005	.....	
3,000	.....	.0007	.....	
4,000	.....	.0009	.....	
5,000	.....	.0012	.....	
6,000	.....	.0015	.....	
7,000	.....	.0019	.....	
8,000	.....	.0022	.....	
9,000	.....	.0025	.....	
10,000	.....	.0028	.....	
11,000	.....	.0031	.....	
12,000	.....	.0034	.....	
13,000	.....	.0038	.....	
14,000	.....	.0042	.....	
15,000	.....	.0046	.....	
16,000	.....	.0052	.....	
17,000	.....	.0059	.....	
18,000	.....	.0096	.....	
19,000	.....	.0235	.....	
20,000	.....	.0308	.0256	
21,000	.....	.03	.....	
24,000	.....	.04	.....	
28,000	.....	.05	.....	
32,000	.....	.06	.....	
36,000	.....	.09	.....	
40,000	.....	.10	.....	
44,000	.....	.11	.....	
48,000	.....	.12	.....	
52,000	.....	.14	.....	
56,000	.....	.16	.....	
60,000	.....	.17	.....	
64,000	.....	.21	.....	
66,700	32,700	.....	.....	Tensile strength.
	38,110	.....	.....	Shearing strength of bolts.

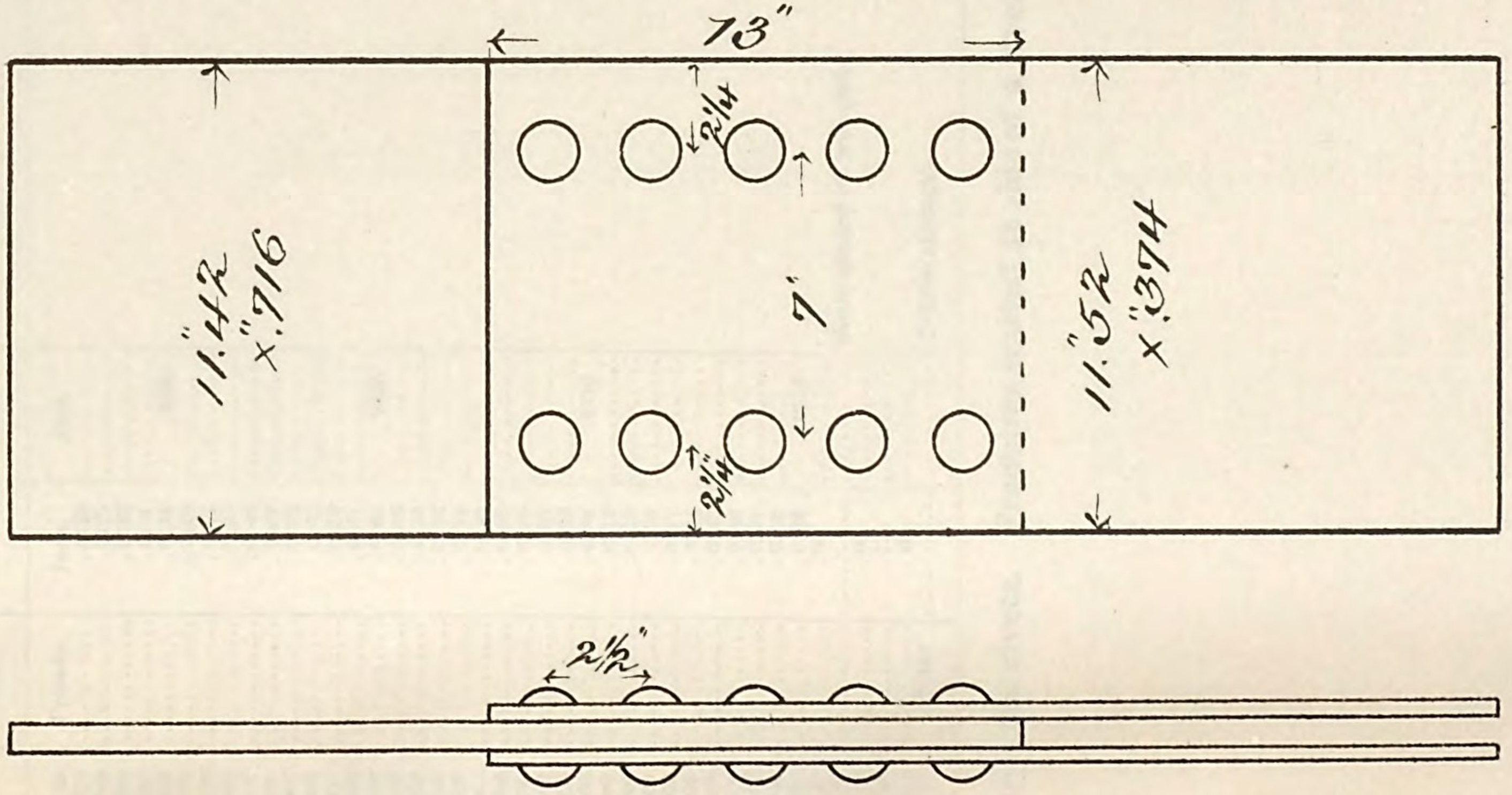
Sheared the bolts.

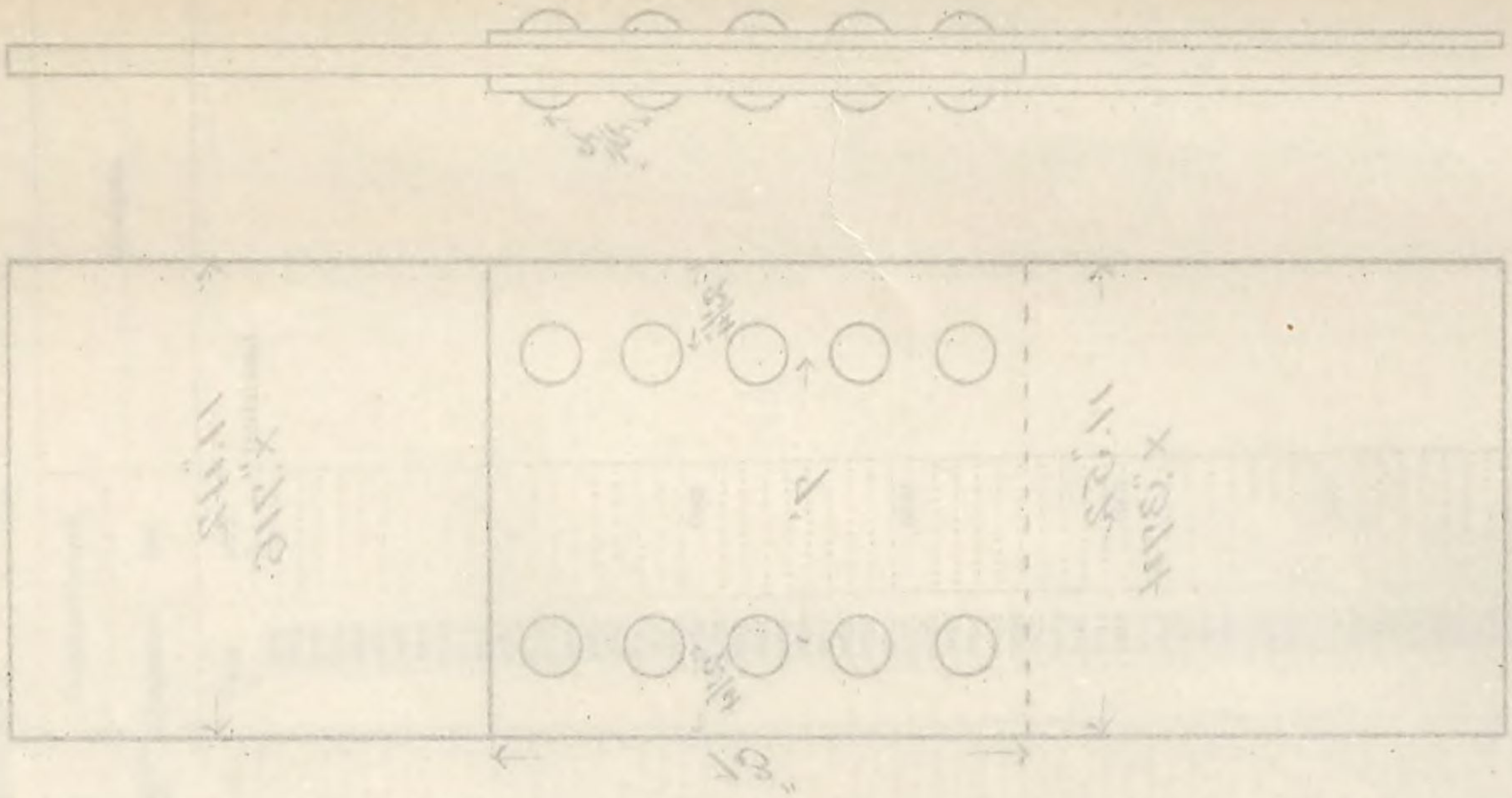
No. 9394.

Marks, T 23.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of web plate, $11''.42 \times ''.716 = 8.18$ square inches.
Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0002	.....	
4,000	.....	.0003	.....	
6,000	.....	.0004	.....	
8,000	.....	.0005	.....	
10,000	.....	.0006	.....	
12,000	.....	.0007	.....	
14,000	.....	.0009	.....	
16,000	.....	.0010	.....	
18,000	.....	.0011	.....	
20,000	.....	.0012	.....	
22,000	.....	.0012	.....	
24,000	.....	.0013	.....	
26,000	.....	.0013	.....	
28,000	.....	.0014	.....	
30,000	.....	.0015	.....	
32,000	.....	.0016	.....	
34,000	.....	.0017	.....	
36,000	.....	.0018	.....	
38,000	.....	.0019	.....	
40,000	.....	.0020	.0002	
42,000	.....	.0022	.....	
44,000	.....	.0023	.....	
46,000	.....	.0024	.....	
48,000	.....	.0025	.....	
50,000	.....	.0026	.....	
52,000	.....	.0027	.....	
54,000	.....	.0028	.....	
56,000	.....	.0029	.....	
58,000	.....	.0030	.....	
60,000	.....	.0031	.0003	
62,000	.....	.0032	.....	
64,000	.....	.0033	.....	
66,000	.....	.0034	.....	
68,000	.....	.0035	.....	
70,000	.....	.0036	.....	
72,000	.....	.0037	.....	
74,000	.....	.0039	.....	
76,000	.....	.0040	.....	
78,000	.....	.0041	.....	
80,000	.....	.0043	.0005	
82,000	.....	.0044	.....	
84,000	.....	.0045	.....	
86,000	.....	.0047	.....	
88,000	.....	.0048	.....	
90,000	.....	.0049	.....	
92,000	.....	.0051	.....	
94,000	.....	.0052	.....	
96,000	.....	.0053	.....	
98,000	.....	.0055	.....	
100,000	.....	.0056	.0010	
102,000	.....	.0058	.....	
104,000	.....	.0060	.....	
106,000	.....	.0062	.....	
108,000	.....	.0064	.....	
110,000	.....	.0066	.....	
112,000	.....	.0069	.....	
114,000	.....	.0071	.....	
116,000	.....	.0098	.....	
118,000	.....	.0100	.....	
120,000	.....	.0102	.0047	
122,000	.....	.0105	.....	
124,000	.....	.0107	.....	
126,000	.....	.0109	.....	
128,000	.....	.0111	.....	
130,000	.....	.0112	.....	

No. 9394.





No. 9394—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
132,000	.....	.0120	.....	
134,000	.....	.0123	.....	
136,000	.....	.0128	.....	
138,000	.....	.0131	.....	
140,000	.....	.0134	.0066	
142,000	.....	.0140	.....	
144,000	.....	.0142	.....	
146,000	.....	.0143	.....	
148,000	.....	.0146	.....	
150,000	.....	.0149	.....	
152,000	.....	.0152	.....	
154,000	.....	.0155	.....	
156,000	.....	.0159	.....	
158,000	.....	.0161	.....	
160,000	.....	.0163	.0085	
162,000	.....	.0168	.....	
164,000	.....	.0170	.....	
166,000	.....	.0173	.....	
168,000	.....	.0178	.....	
170,000	.....	.0180	.....	
172,000	.....	.0183	.....	
174,000	.....	.0186	.....	
176,000	.....	.0191	.....	
178,000	.....	.0196	.....	
180,000	.....	.0204	.0110	
182,000	.....	.0212	.....	
184,000	.....	.0219	.....	
186,000	.....	.0224	.....	
188,000	.....	.0227	.....	
190,000	.....	.0234	.....	
192,000	.....	.0240	.....	
194,000	.....	.0246	.....	
196,000	.....	.0251	.....	
198,000	.....	.0259	.....	
200,000	.....	.0276	.0159	
220,000	.....	.03	.....	
230,000	.....	.....	.....	Scale started off web plate.
240,000	.....	.06	.....	
260,000	.....	.12	.....	
280,000	.....	.19	.....	
292,900	35,810	.....	.....	Tensile strength.

Sheared the rivets. Fractures started at side of a rivet hole in web plate.

No. 9395.

Marks, T 24.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}$, die $\frac{3}{4}''$ diameter.

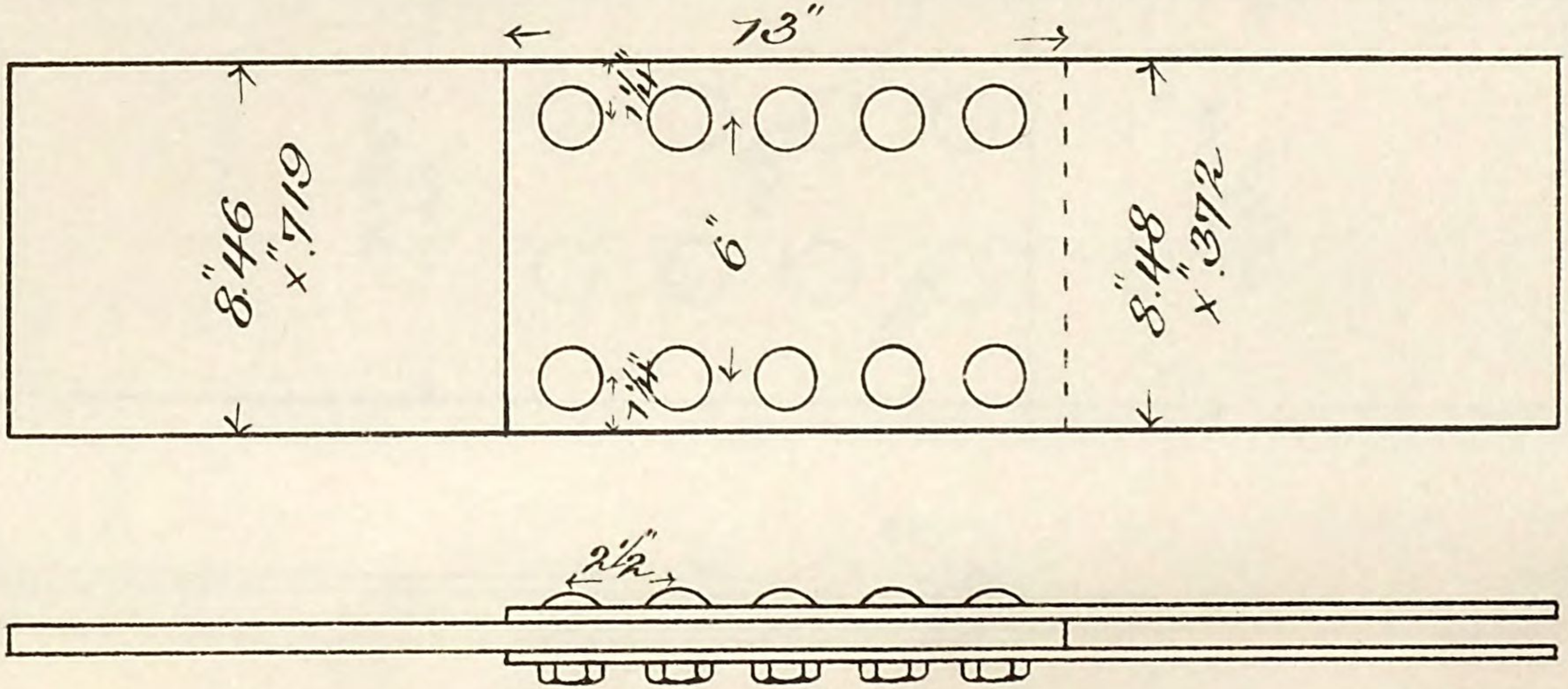
Gross sectional area of web plate, $8''.46 \times ''.719$ ..... square inches.. 6.08
Shearing area of bolts, ''.61 diameter ..... do.... 5.84

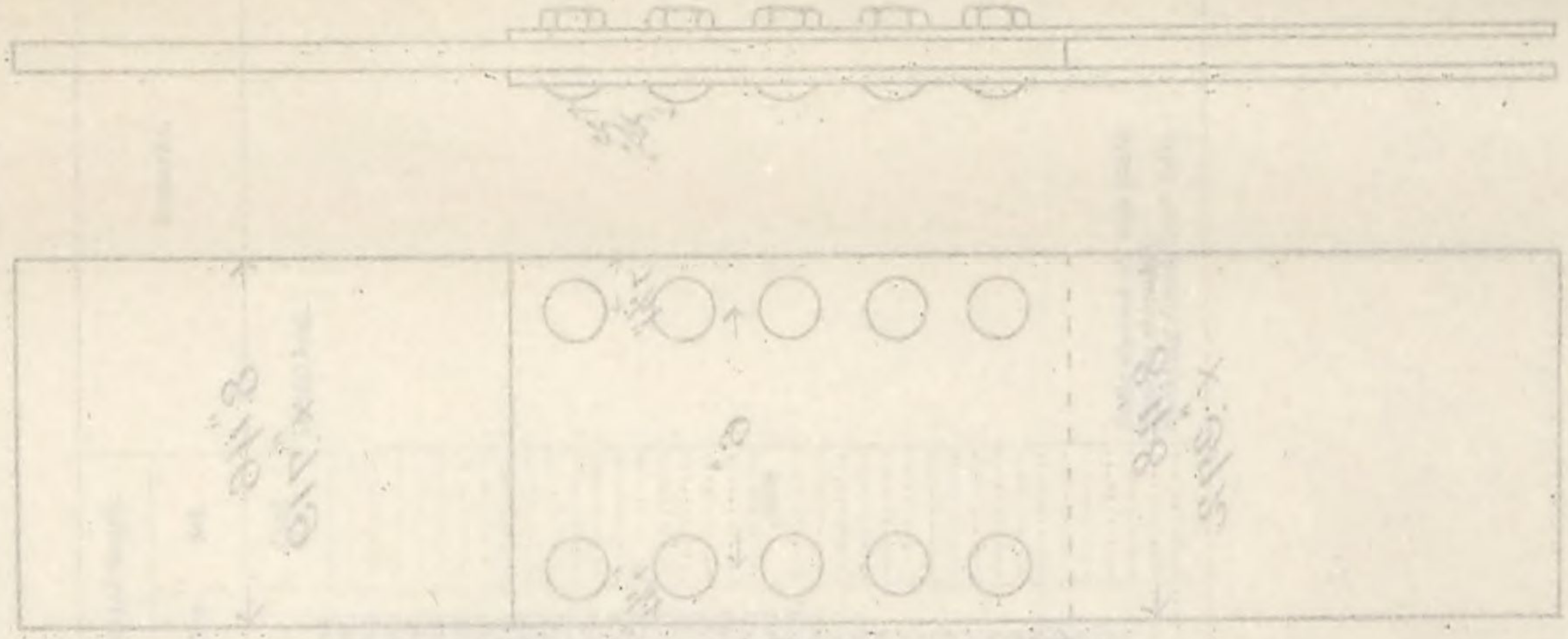
Gauged length, 15''.

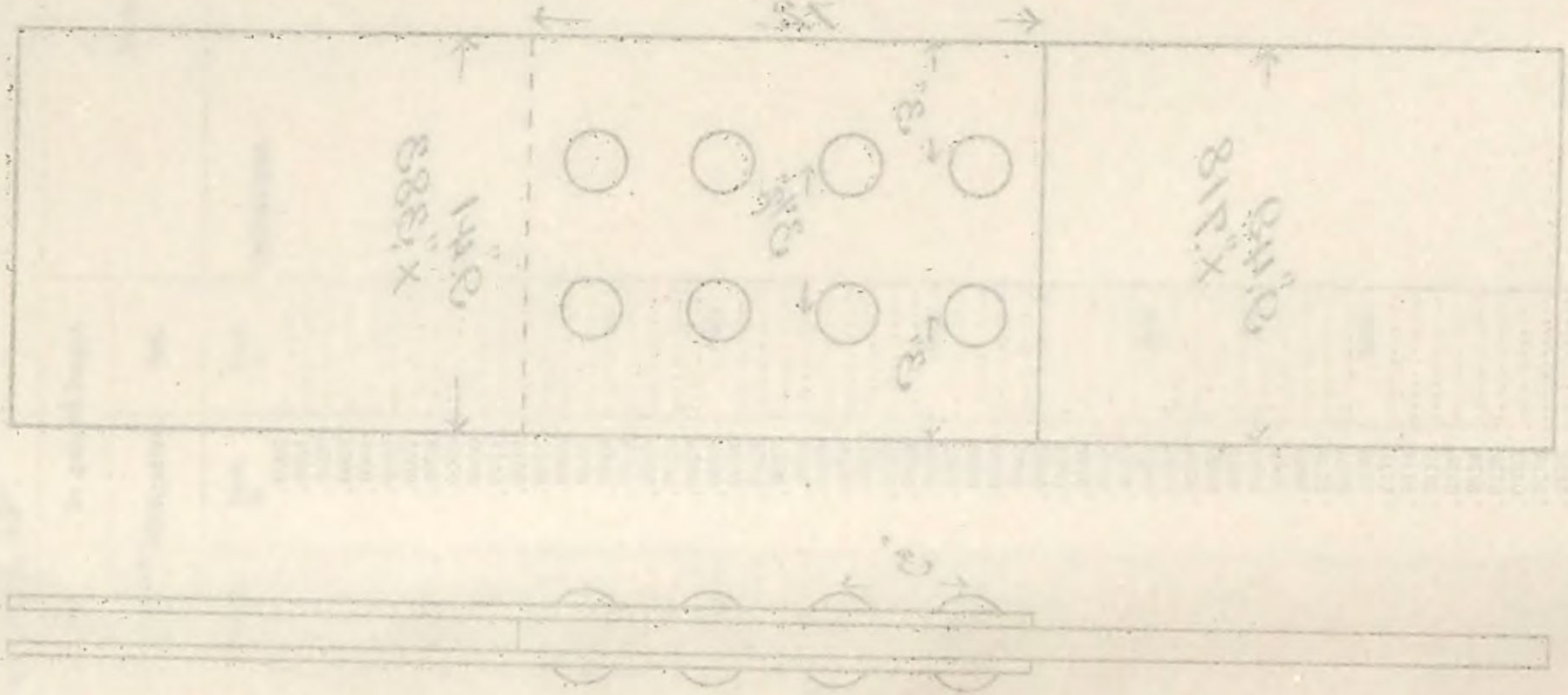
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
4,000	.....	.0002	.....	
6,000	.....	.0004	.....	
8,000	.....	.0005	.....	
10,000	.....	.0006	.....	
12,000	.....	.0008	.....	
14,000	.....	.0009	.....	
16,000	.....	.0011	.....	
18,000	.....	.0013	.....	
20,000	.....	.0015	.....	
22,000	.....	.0016	.....	
24,000	.....	.0018	.....	
26,000	.....	.0020	.....	
28,000	.....	.0022	.....	
30,000	.....	.0024	.....	
32,000	.....	.0026	.....	
34,000	.....	.0028	.....	
36,000	.....	.0029	.....	
38,000	.....	.0032	.....	
40,000	.....	.0034	.0008	
42,000	.....	.0038	.....	
44,000	.....	.0041	.....	
46,000	.....	.06	.....	
50,000	.....	.06+	.....	
60,000	.....	.08	.....	
70,000	.....	.10	.....	
80,000	.....	.11	.....	
90,000	.....	.12	.....	
100,000	.....	.13	.....	
110,000	.....	.15	.....	
120,000	.....	.16	.....	
130,000	.....	.16+	.....	
140,000	.....	.17	.....	
150,000	.....	.19	.....	
160,000	.....	.21	.....	
170,000	.....	.25	.....	Scale started off web plate.
179,200	29,470	.....	.....	Tensile strength.
	30,680	.....	.....	Shearing strength of bolts.

Sheared the bolts.

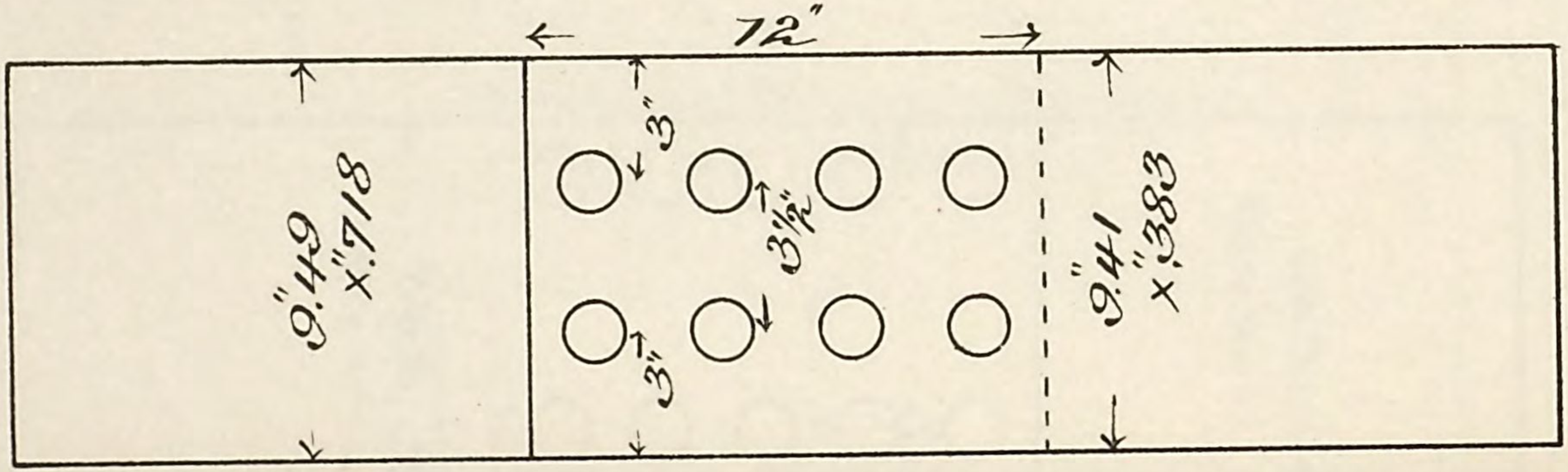
No. 9395.

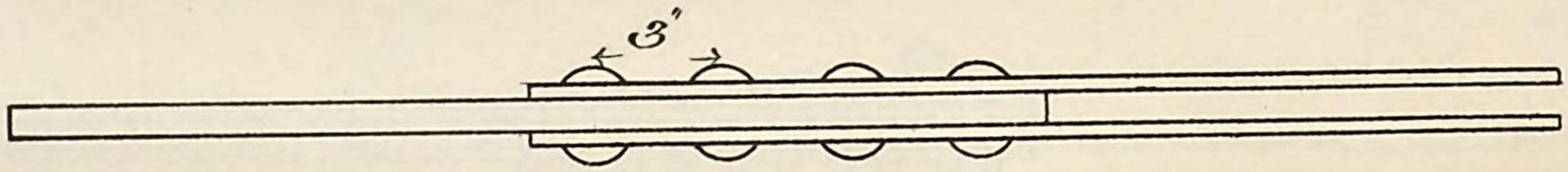






No. 9396.





No. 9396.

Marks, T 15.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{1}{1}\frac{1}{6}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of plate, $9''.49 \times ''.718 = 6.81$ square inches.
Gauged length, $15''$.

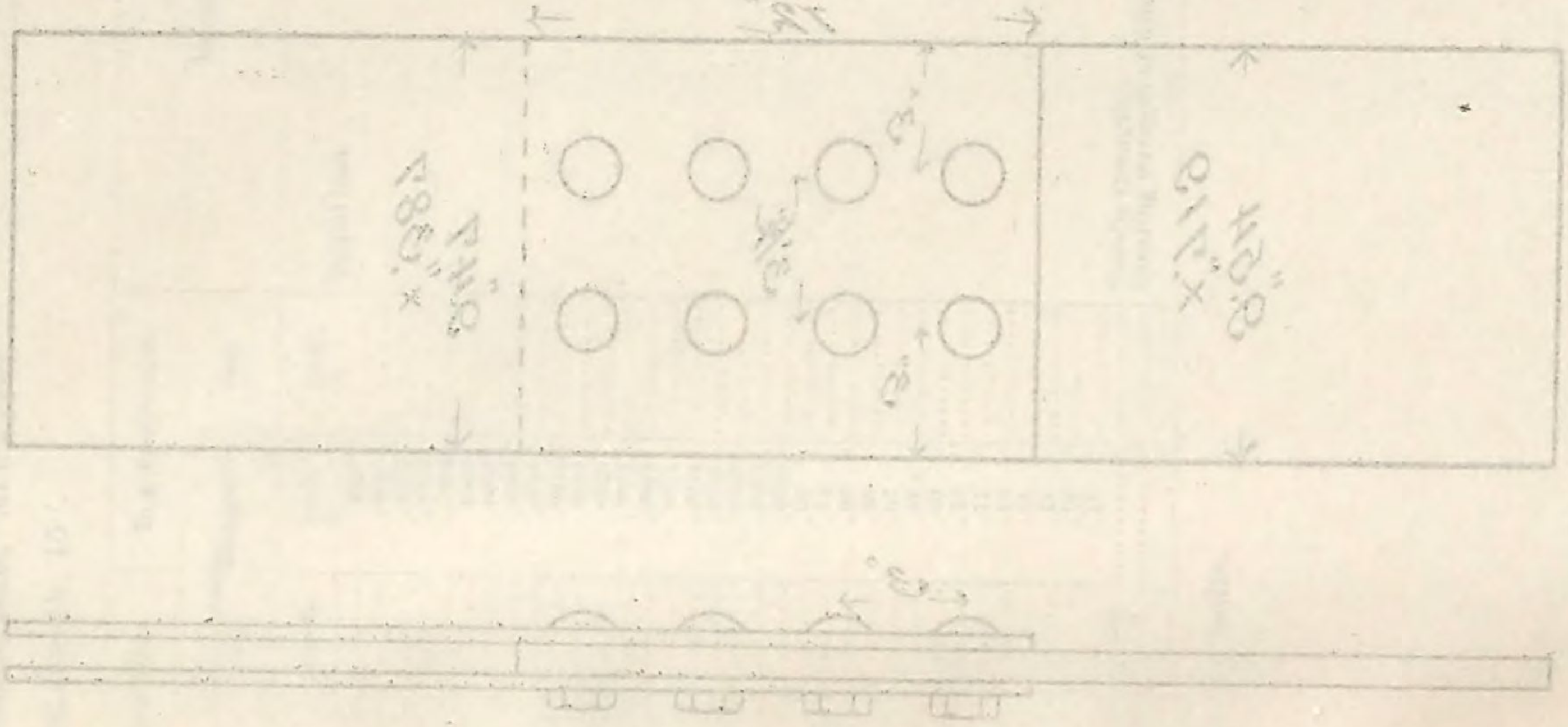
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0001	.....	
4,000	.....	.0002	.....	
6,000	.....	.0003	.....	
8,000	.....	.0004	.....	
10,000	.....	.0005	.....	
12,000	.....	.0007	.....	
14,000	.....	.0008	.....	
16,000	.....	.0009	.....	
18,000	.....	.0010	.....	
20,000	.....	.0011	.....	
22,000	.....	.0012	.....	
24,000	.....	.0013	.....	
26,000	.....	.0014	.....	
28,000	.....	.0015	.....	
30,000	.....	.0016	.....	
32,000	.....	.0018	.....	
34,000	.....	.0019	.....	
36,000	.....	.0021	.....	
38,000	.....	.0022	.....	
40,000	.....	.0023	.0001	
42,000	.....	.0024	.....	
44,000	.....	.0026	.....	
46,000	.....	.0027	.....	
48,000	.....	.0028	.....	
50,000	.....	.0029	.....	
52,000	.....	.0030	.....	
54,000	.....	.0031	.....	
56,000	.....	.0032	.....	
58,000	.....	.0034	.....	
60,000	.....	.0036	.0002	
62,000	.....	.0037	.....	
64,000	.....	.0038	.....	
66,000	.....	.0040	.....	
68,000	.....	.0041	.....	
70,000	.....	.0042	.....	
72,000	.....	.0044	.....	
74,000	.....	.0046	.....	
76,000	.....	.0048	.....	
78,000	.....	.0050	.....	
80,000	.....	.0051	.0006	
82,000	.....	.0054	.....	
84,000	.....	.0056	.....	
86,000	.....	.0060	.....	
88,000	.....	.0079	.....	
90,000	.....	.0087	.....	
92,000	.....	.0093	.....	
94,000	.....	.0098	.....	
96,000	.....	.0103	.....	
98,000	.....	.0107	.....	
100,000	.....	.0109	.0050	
102,000	.....	.0112	.....	
104,000	.....	.0114	.....	
106,000	.....	.0118	.....	
108,000	.....	.0120	.....	
110,000	.....	.0124	.....	
112,000	.....	.0128	.....	
114,000	.....	.0131	.....	
116,000	.....	.0134	.....	
118,000	.....	.0137	.....	
120,000	.....	.0139	.0068	
122,000	.....	.0144	.....	
124,000	.....	.0147	.....	
126,000	.....	.0150	.....	
128,000	.....	.0153	.....	
130,000	.....	.0158	.....	
132,000	.....	.0161	.....	
134,000	.....	.0168	.....	

No. 9396—Continued.

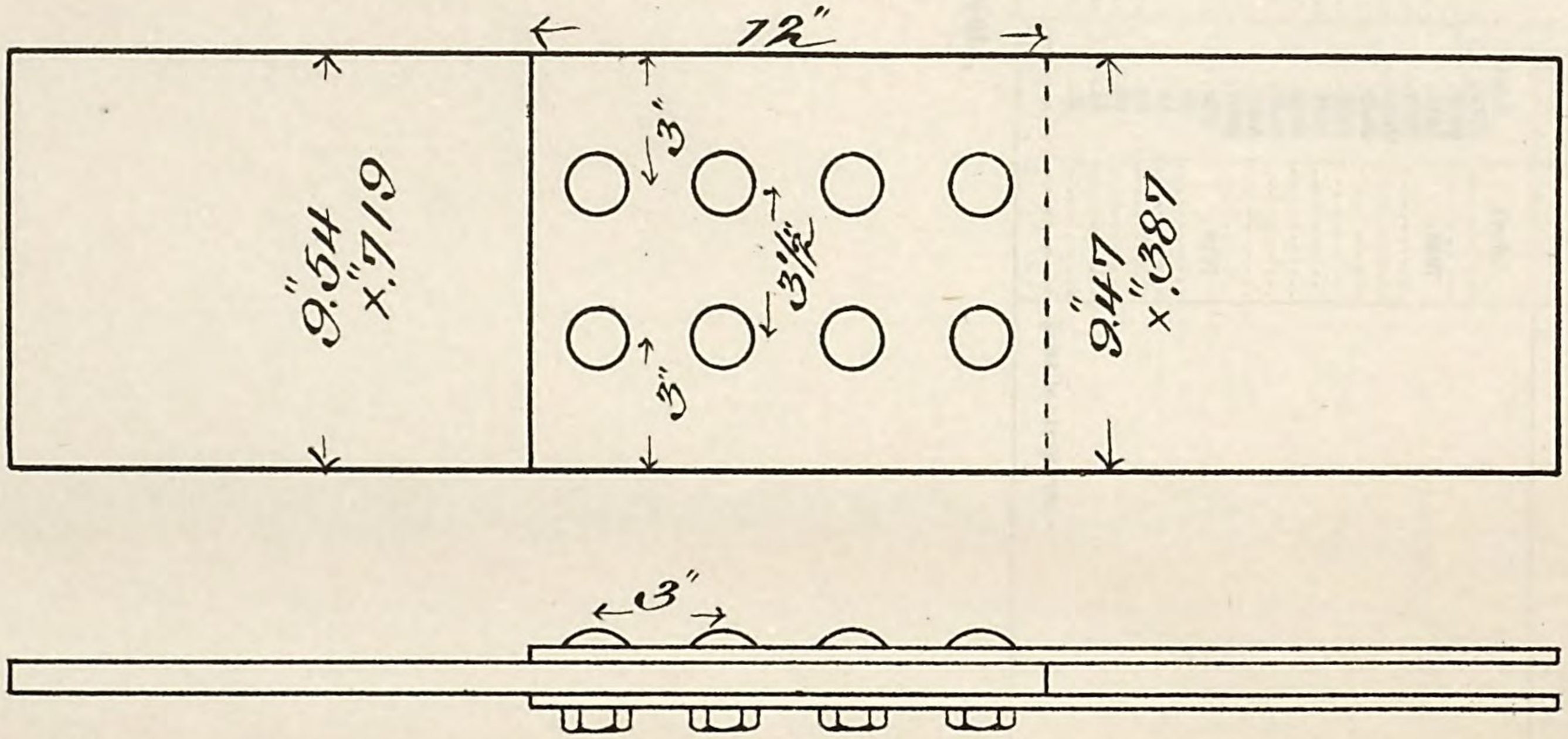
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
136,000	.....	.0173	.....	
138,000	.....	.0179	.....	
140,000	.....	.0185	.0097	
142,000	.....	.0193	.....	
144,000	.....	.0195	.....	
146,000	.....	.0199	.....	
148,000	.....	.0213	.....	
150,000	.....	.0223	.....	
152,000	.....	.0231	.....	
154,000	.....	.0239	.....	
156,000	.....	.0256	.....	
158,000	.....	.0264	.....	
160,000	.....	.0277	.0157	
170,000	.....	.03	.....	
180,000	.....	.04	.....	
190,000	.....	.08	.....	
200,000	.....	.09	.....	
220,000	.....	.14	.....	
240,000	.....	.23	.....	
247,200	36,300	.....	.....	Tensile strength.

Sheared the rivets.

No. 9397.



No. 9397.



No. 9397.

Marks, T 16.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of plate $9''.54 \times ''.719$ ..... square inches.. 6.86
Shearing area of bolts, $''.61$ diameter ..... do.... 4.67

Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
4,000	.....	.0002	.....	
6,000	.....	.0003	.....	
8,000	.....	.0004	.....	
10,000	.....	.0006	.....	
12,000	.....	.0008	.....	
14,000	.....	.0009	.....	
16,000	.....	.0010	.....	
18,000	.....	.0011	.....	
20,000	.....	.0013	.....	
22,000	.....	.0015	.....	
24,000	.....	.0017	.....	
26,000	.....	.0019	.....	
28,000	.....	.0021	.....	
30,000	.....	.0024	.....	
32,000	.....	.0030	.....	
34,000	.....	.0037	.....	
36,000	.....	.0205	.....	
38,000	.....	.0259	.....	
40,000	.....	.03	.....	
46,000	.....	.04	.....	
50,000	.....	.05	.....	
60,000	.....	.06	.....	
70,000	.....	.07	.....	
80,000	.....	.07+	.....	
90,000	.....	.09	.....	
100,000	.....	.10	.....	
110,000	.....	.11	.....	
120,000	.....	.12	.....	
130,000	.....	.13	.....	
140,000	.....	.14	.....	
150,000	.....	.16	.....	
160,000	.....	.18	.....	
160,500	23,390	.....	.....	Tensile strength.
	34,370	.....	.....	Shearing strength of bolts.

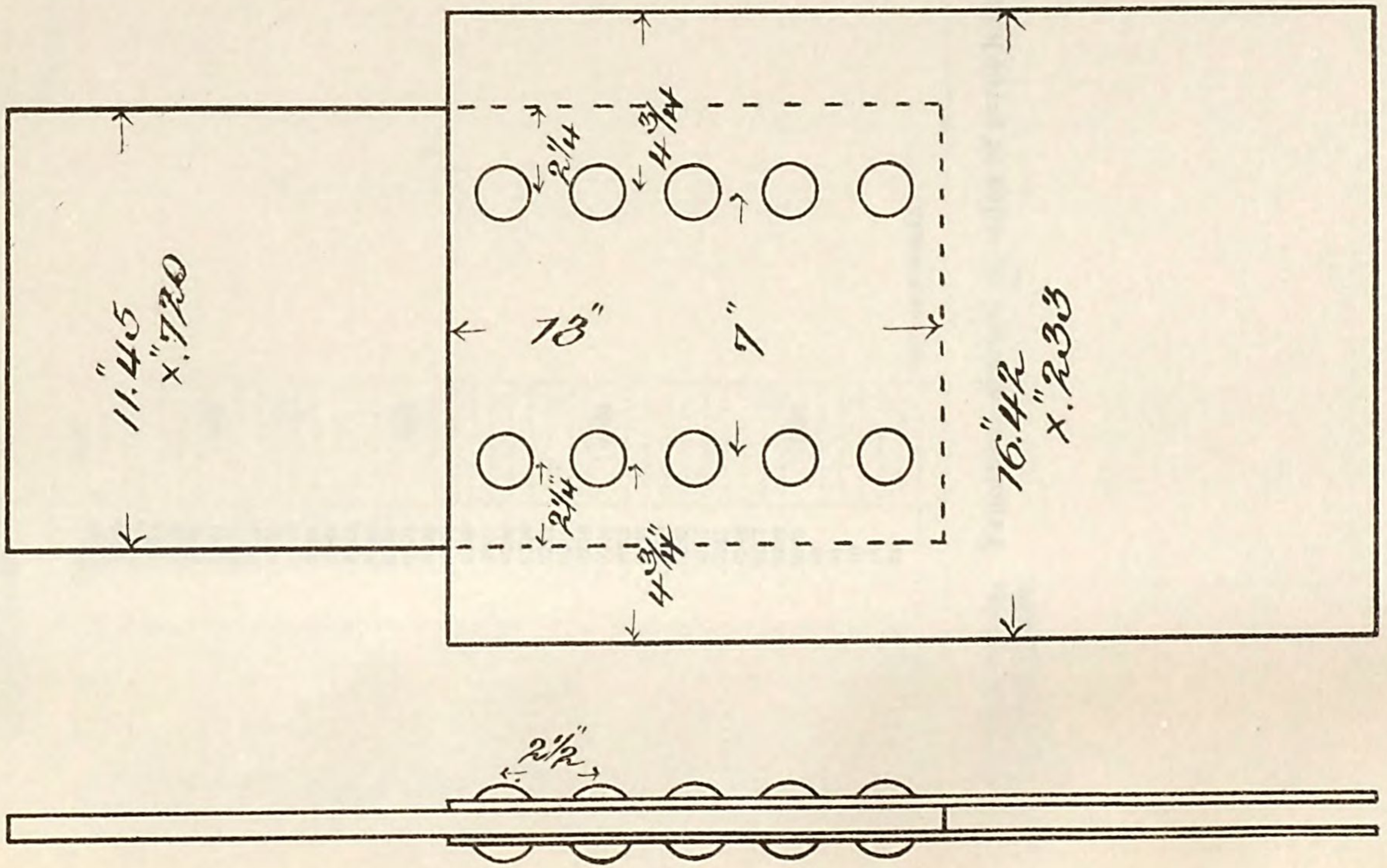
Sheared the bolts.

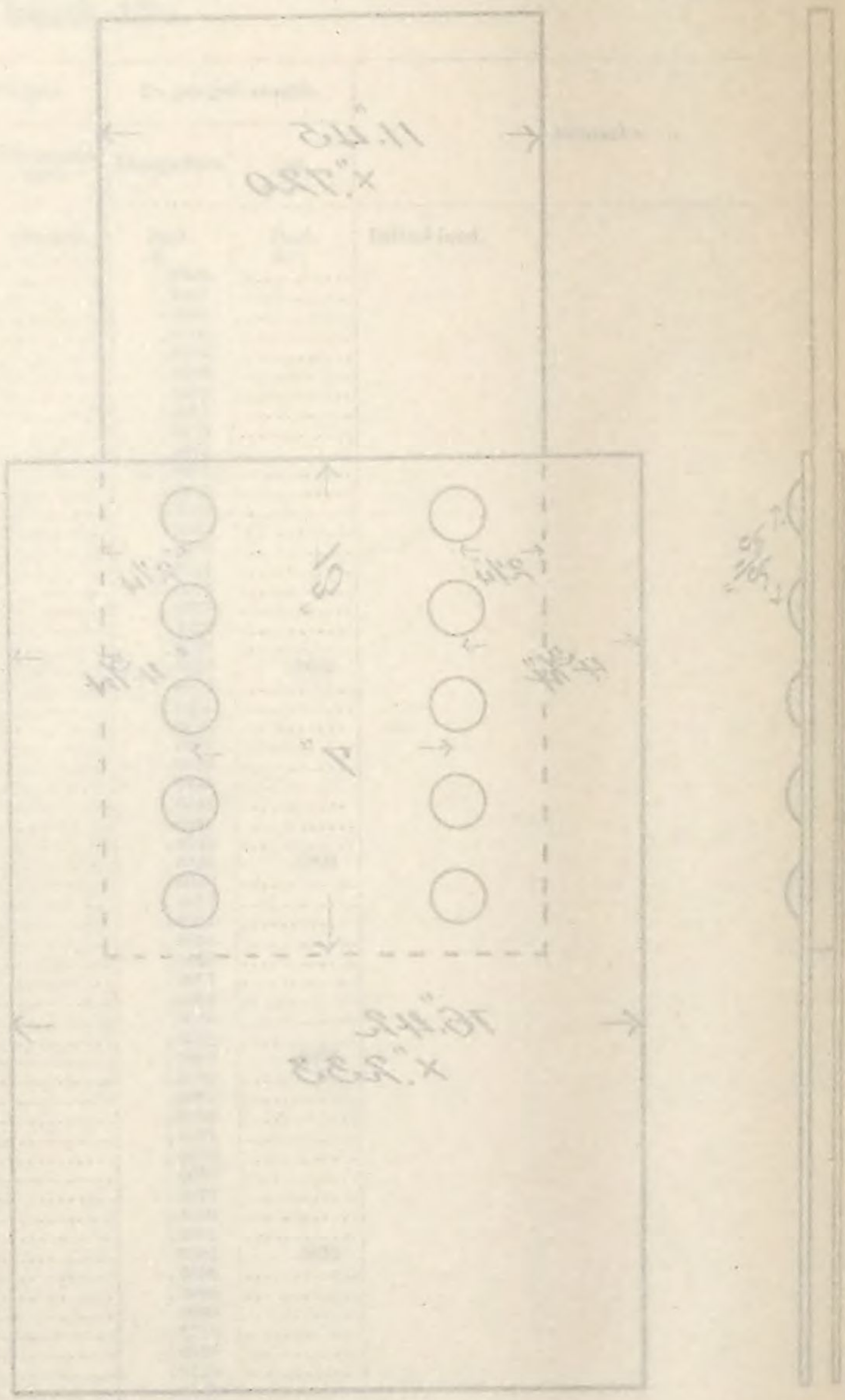
No. 9398.

Marks, T 27.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of web plate, $11''.45 \times ''.720 = 16.42$ square inches.
Gauged length, $15''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0000	.....	
2,000	.....	.0001	.....	
4,000	.....	.0003	.....	
6,000	.....	.0005	.....	
8,000	.....	.0006	.....	
10,000	.....	.0008	.....	
12,000	.....	.0009	.....	
14,000	.....	.0011	.....	
16,000	.....	.0013	.....	
18,000	.....	.0014	.....	
20,000	.....	.0016	.....	
22,000	.....	.0018	.....	
24,000	.....	.0019	.....	
26,000	.....	.0020	.....	
28,000	.....	.0022	.....	
30,000	.....	.0024	.....	
32,000	.....	.0026	.....	
34,000	.....	.0027	.....	
36,000	.....	.0028	.....	
38,000	.....	.0029	.....	
40,000	.....	.0030	.0002	
42,000	.....	.0032	.....	
44,000	.....	.0034	.....	
46,000	.....	.0035	.....	
48,000	.....	.0037	.....	
50,000	.....	.0039	.....	
52,000	.....	.0040	.....	
54,000	.....	.0041	.....	
56,000	.....	.0043	.....	
58,000	.....	.0045	.....	
60,000	.....	.0046	.0003	
62,000	.....	.0048	.....	
64,000	.....	.0050	.....	
66,000	.....	.0051	.....	
68,000	.....	.0053	.....	
70,000	.....	.0055	.....	
72,000	.....	.0057	.....	
74,000	.....	.0059	.....	
76,000	.....	.0060	.....	
78,000	.....	.0062	.....	
80,000	.....	.0063	.0007	
82,000	.....	.0065	.....	
84,000	.....	.0067	.....	
86,000	.....	.0069	.....	
88,000	.....	.0071	.....	
90,000	.....	.0073	.....	
92,000	.....	.0075	.....	
94,000	.....	.0077	.....	
96,000	.....	.0079	.....	
98,000	.....	.0081	.....	
100,000	.....	.0084	.0013	
102,000	.....	.0086	.....	
104,000	.....	.0088	.....	
106,000	.....	.0093	.....	
108,000	.....	.0116	.....	
110,000	.....	.0120	.....	
112,000	.....	.0125	.....	
114,000	.....	.0129	.....	
116,000	.....	.0131	.....	
118,000	.....	.0134	.....	
120,000	.....	.0136	.0050	
122,000	.....	.0139	.....	
124,000	.....	.0142	.....	
126,000	.....	.0145	.....	

No. 9398.





No. 9398—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
128,000	.....	.0147	.....	
130,000	.....	.0150	.....	
132,000	.....	.0153	.....	
134,000	.....	.0156	.....	
136,000	.....	.0159	.....	
138,000	.....	.0161	.....	
140,000	.....	.0164	.0062	
142,000	.....	.0170	.....	
144,000	.....	.0173	.....	
146,000	.....	.0175	.....	
148,000	.....	.0179	.....	
150,000	.....	.0182	.....	
152,000	.....	.0184	.....	
154,000	.....	.0186	.....	
156,000	.....	.0188	.....	
158,000	.....	.0190	.....	
160,000	.....	.0191	.0072	
162,000	.....	.0195	.....	
164,000	.....	.0197	.....	
166,000	.....	.0199	.....	
168,000	.....	.0201	.....	
170,000	.....	.0204	.....	
172,000	.....	.0206	.....	
174,000	.....	.0211	.....	
176,000	.....	.0214	.....	
178,000	.....	.0216	.....	
180,000	.....	.0220	.0089	
182,000	.....	.0222	.....	
184,000	.....	.0227	.....	
186,000	.....	.0229	.....	
188,000	.....	.0232	.....	
190,000	.....	.0237	.....	
192,000	.....	.0241	.....	
194,000	.....	.0246	.....	
196,000	.....	.0257	.....	
198,000	.....	.0259	.....	
200,000	.....	.0265	.0122	
220,000	.....	.03	.....	
240,000	.....	.04	.....	
260,000	.....	.10	.....	
280,000	.....	.16	.....	
300,000	.....	.24	.....	
308,100	37,390	.....	.....	Tensile strength.

Sheared the rivets. Fractures started at sides of rivet holes in first row in the web plate.

No. 9399.

Marks, T 28.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

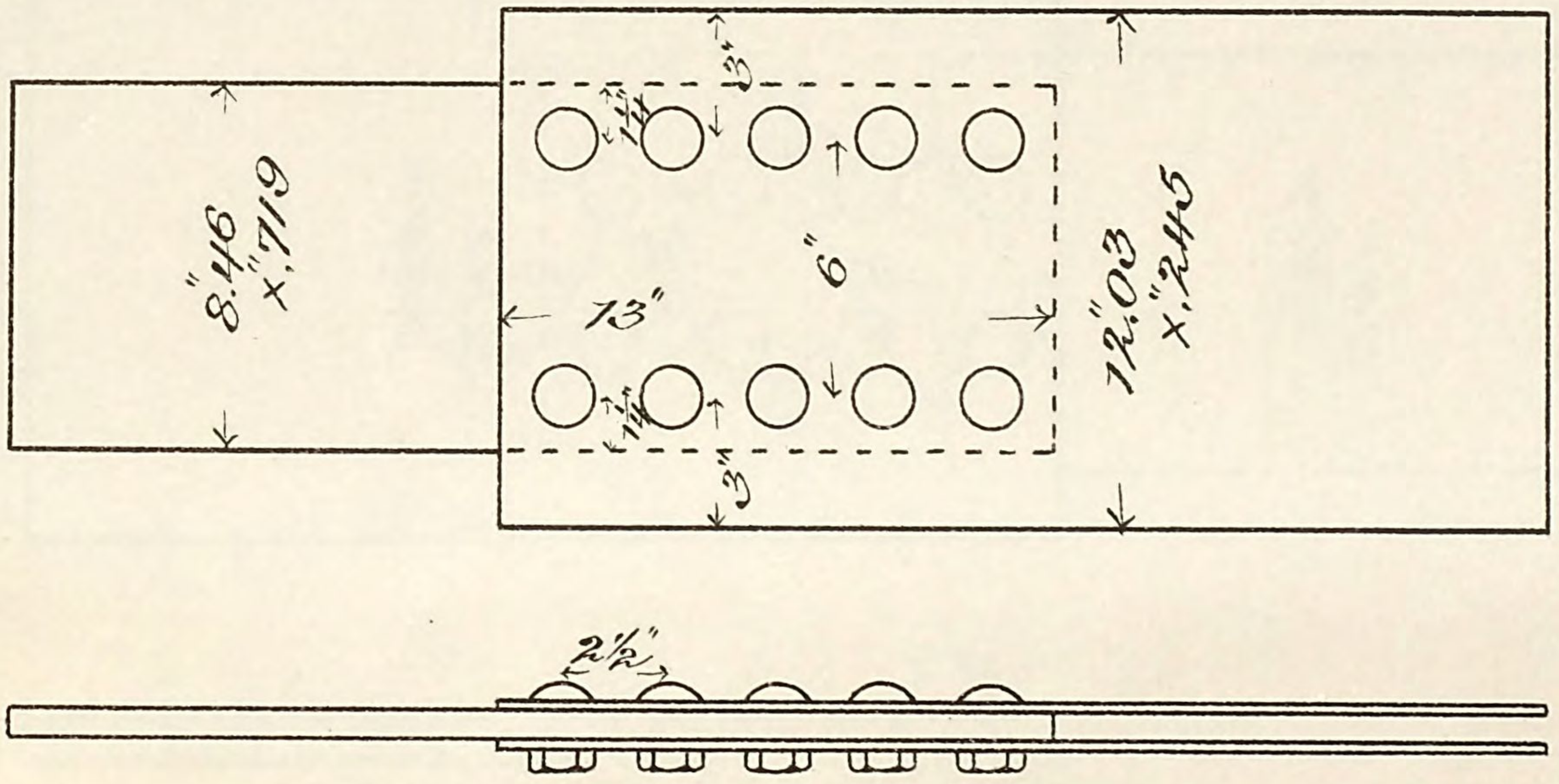
Gross sectional area of web plate, 8″.46 × ″.719.....square inches.. 6.08
Shearing area of bolts, ″.61 diameter.....do.... 5.84

Gauged length, 15″.

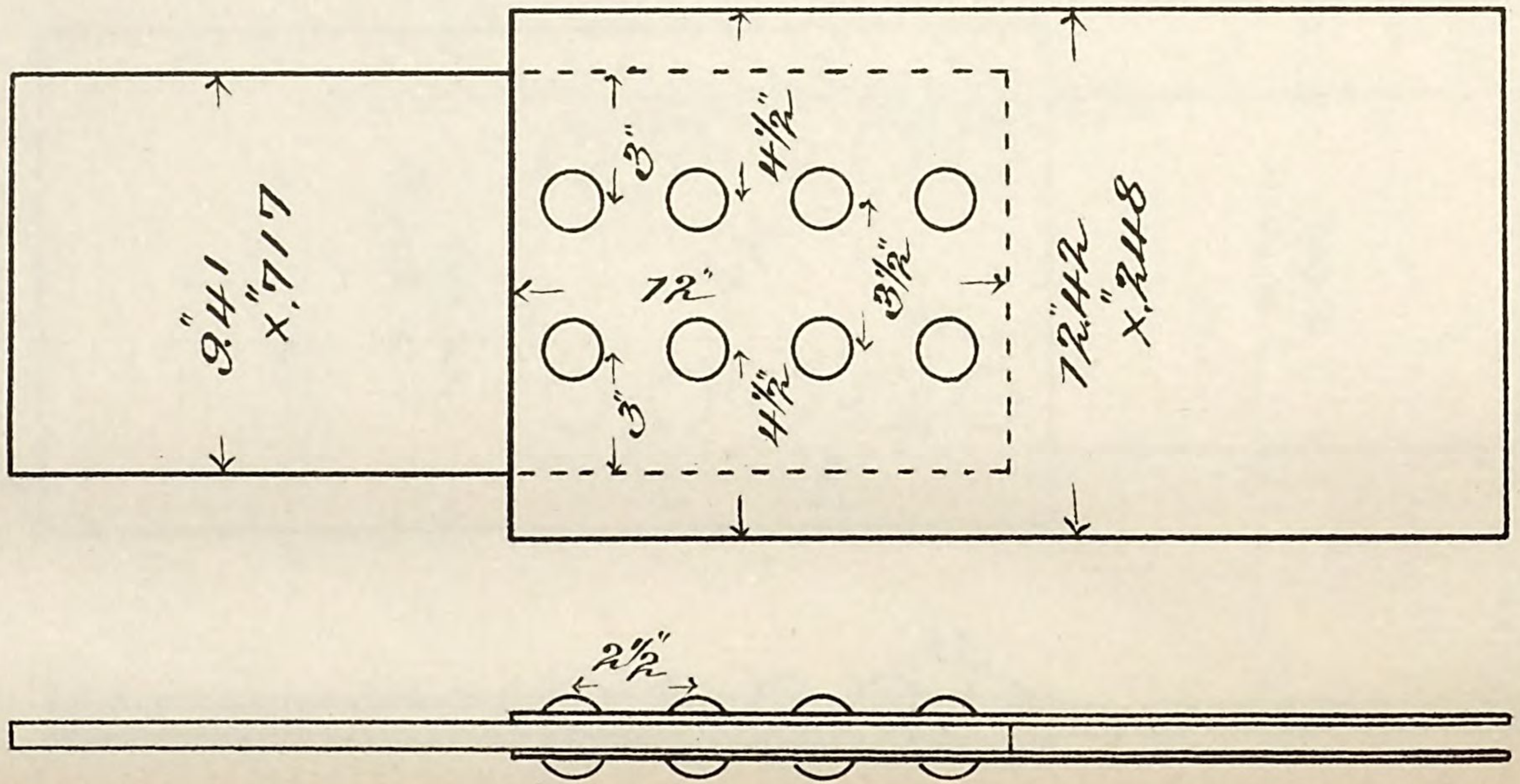
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0001	.....	
4,000	.....	.0003	.....	
6,000	.....	.0005	.....	
8,000	.....	.0006	.....	
10,000	.....	.0008	.....	
12,000	.....	.0010	.....	
14,000	.....	.0011	.....	
16,000	.....	.0012	.....	
18,000	.....	.0013	.....	
20,000	.....	.0015	.....	
22,000	.....	.0017	.....	
24,000	.....	.0019	.....	
26,000	.....	.0020	.....	
28,000	.....	.0022	.....	
30,000	.....	.0024	.....	
32,000	.....	.0025	.....	
34,000	.....	.0027	.....	
36,000	.....	.0029	.....	
38,000	.....	.0031	.....	
40,000	.....	.0032	.0004	
42,000	.....	.0034	.....	
44,000	.....	.0036	.....	
46,000	.....	.0038	.....	
48,000	.....	.0040	.....	
50,000	.....	.0043	.....	
52,000	.....	.0047	.....	
54,000	.....	.0051	.....	
56,000	.....	.06	.....	
60,000	.....	.07	.....	
70,000	.....	.08	.....	
80,000	.....	.11	.....	
90,000	.....	.12	.....	
100,000	.....	.13	.....	
110,000	.....	.15	.....	
120,000	.....	.16	.....	
130,000	.....	.17	.....	
140,000	.....	.18	.....	
150,000	.....	.19	.....	
160,000	.....	.21	.....	
170,000	.....	.24	.....	
189,900	31,230	.....	.....	Tensile strength.
	32,520	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9399.



No. 9400.



No. 9400.

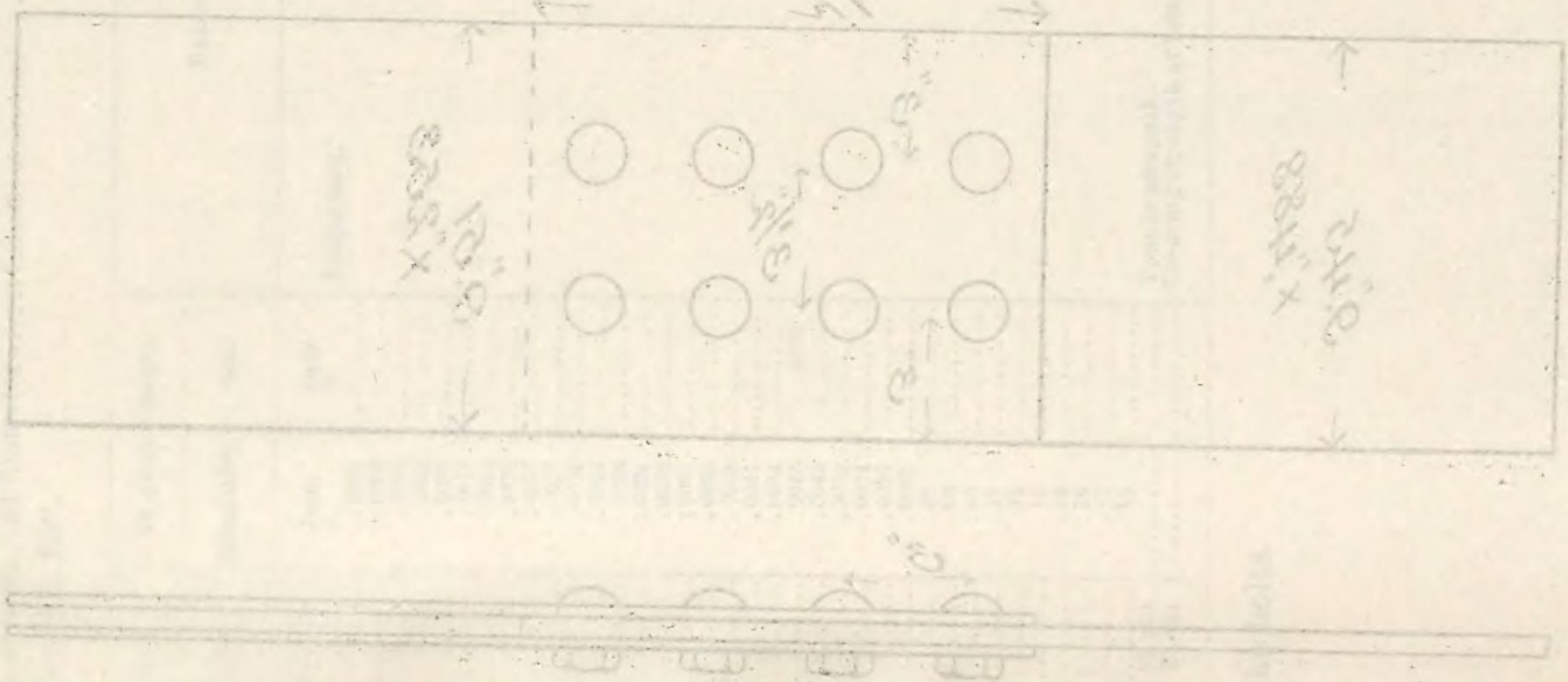
Marks, T 19.
$\frac{3}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of wet plate, $9''.41 \times ''.717 = 6.75$ square inches.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0001	.....	
4,000	.....	.0002	.....	
6,000	.....	.0003	.....	
8,000	.....	.0004	.....	
10,000	.....	.0006	.....	
12,000	.....	.0007	.....	
14,000	.....	.0008	.....	
16,000	.....	.0009	.....	
18,000	.....	.0010	.....	
20,000	.....	.0012	.....	
22,000	.....	.0013	.....	
24,000	.....	.0014	.....	
26,000	.....	.0016	.....	
28,000	.....	.0018	.....	
30,000	.....	.0019	.....	
32,000	.....	.0020	.....	
34,000	.....	.0022	.....	
36,000	.....	.0023	.....	
38,000	.....	.0024	.....	
40,000	.....	.0026	.0001	
42,000	.....	.0027	.....	
44,000	.....	.0028	.....	
46,000	.....	.0029	.....	
48,000	.....	.0031	.....	
50,000	.....	.0032	.....	
52,000	.....	.0034	.....	
54,000	.....	.0036	.....	
56,000	.....	.0037	.....	
58,000	.....	.0039	.....	
60,000	.....	.0040	.0002	
62,000	.....	.0042	.....	
64,000	.....	.0044	.....	
66,000	.....	.0046	.....	
68,000	.....	.0047	.....	
70,000	.....	.0049	.....	
72,000	.....	.0051	.....	
74,000	.....	.0053	.....	
76,000	.....	.0055	.....	
78,000	.....	.0058	.....	
80,000	.....	.0061	.0009	
82,000	.....	.0065	.....	
84,000	.....	.0070	.....	
86,000	.....	.0076	.....	
88,000	.....	.0081	.....	
90,000	.....	.0086	.....	
92,000	.....	.0090	.....	
94,000	.....	.0095	.....	
96,000	.....	.0098	.....	
98,000	.....	.0102	.....	
100,000	.....	.0106	.0040	
102,000	.....	.0109	.....	
104,000	.....	.0111	.....	
106,000	.....	.0115	.....	
108,000	.....	.0118	.....	
110,000	.....	.0121	.....	
112,000	.....	.0124	.....	
114,000	.....	.0127	.....	
116,000	.....	.0130	.....	
118,000	.....	.0132	.....	
120,000	.....	.0134	.0055	
122,000	.....	.0138	.....	
124,000	.....	.0140	.....	
126,000	.....	.0143	.....	
128,000	.....	.0146	.....	
130,000	.....	.0148	.....	
132,000	.....	.0150	.....	

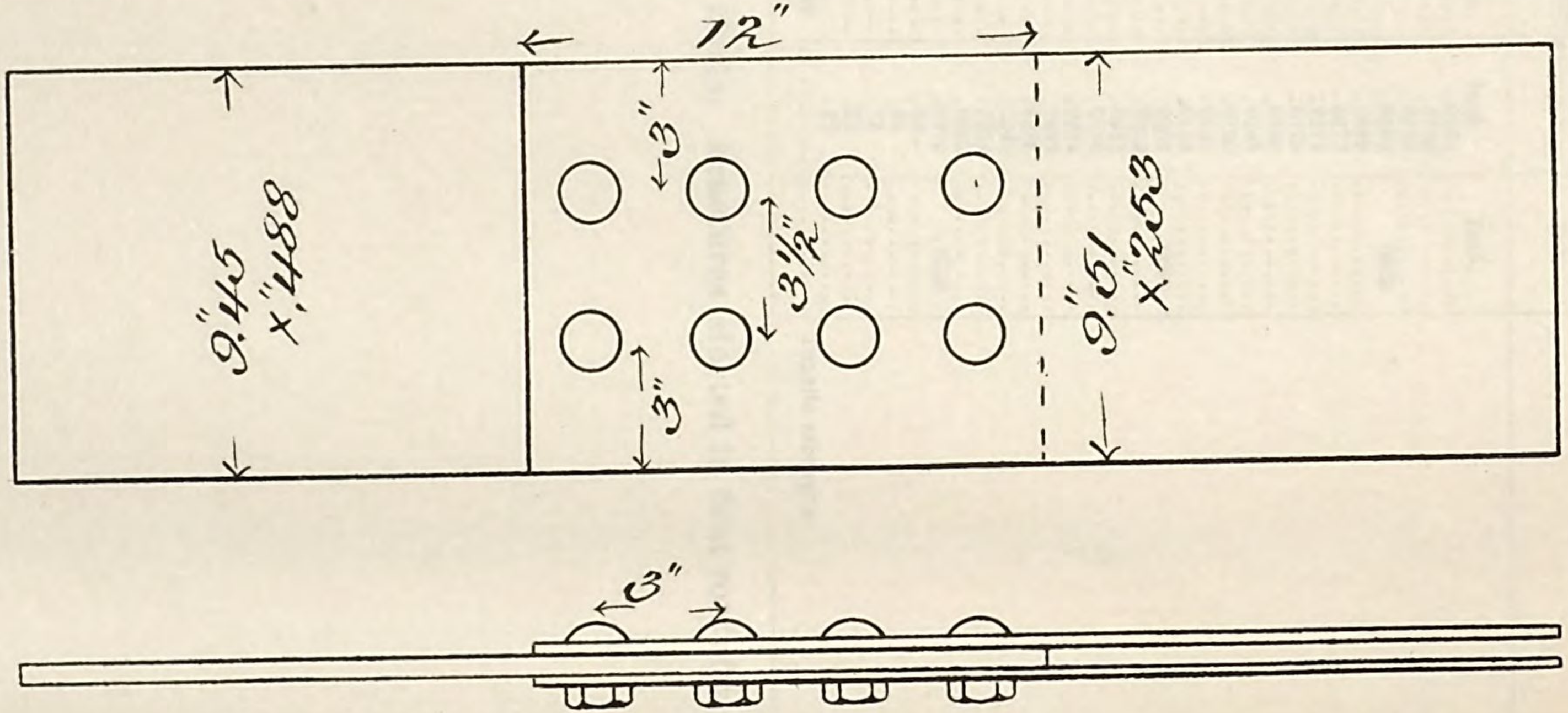
No. 9400—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
134,000	.....	.0154	.....	
136,000	.....	.0156	.....	
138,000	.....	.0159	.....	
140,000	.....	.0163	.0069	
142,000	.....	.0169	.....	
144,000	.....	.0172	.....	
146,000	.....	.0174	.....	
148,000	.....	.0178	.....	
150,000	.....	.0180	.....	
152,000	.....	.0185	.....	
154,000	.....	.0190	.....	
156,000	.....	.0194	.....	
158,000	.....	.0198	.....	
160,000	.....	.0203	.0090	
162,000	.....	.0210	.....	
164,000	.....	.0212	.....	
166,000	.....	.0216	.....	
168,000	.....	.0224	.....	
170,000	.....	.0229	.....	
172,000	.....	.0236	.....	
174,000	.....	.0246	.....	
176,000	.....	.0254	.....	
178,000	.....	.0262	.....	
180,000	.....	.0270	.0139	
190,000	.....	.03+	.....	
200,000	.....	.06	.....	
220,000	.....	.13	.....	
240,000	.....	.22	.....	
260,000	.....	.35	.....	
261,800	38,780	.....	.....	Tensile strength.

Sheared the rivets. Fractures started in first row of rivet holes in the web.



No. 9401.



No. 9401.

Marks, T 20.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of web plate, 9″.45 × ″.488.....square inches.. 4.61
Shearing area of bolts, ″.61 diameter .....do.... 4.67

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0002	.....	
4,000	.....	.0005	.....	
6,000	.....	.0008	.....	
8,000	.....	.0009	.....	
10,000	.....	.0011	.....	
12,000	.....	.0013	.....	
14,000	.....	.0015	.....	
16,000	.....	.0017	.....	
18,000	.....	.0020	.....	
20,000	.....	.0022	.....	
22,000	.....	.0024	.....	
24,000	.....	.0026	.....	
26,000	.....	.0028	.....	
28,000	.....	.0032	.....	
30,000	.....	.0035	.....	
32,000	.....	.0036	.....	
34,000	.....	.0038	.....	
36,000	.....	.0041	.....	
38,000	.....	.0044	.....	
40,000	.....	.0046	.0002	
42,000	.....	.0049	.....	
44,000	.....	.0052	.....	
46,000	.....	.0054	.....	
48,000	.....	.0057	.....	
50,000	.....	.0061	.....	
52,000	.....	.05	.....	
60,000	.....	.08	.....	
70,000	.....	.09	.....	
80,000	.....	.11	.....	
90,000	.....	.12	.....	
100,000	.....	.13	.....	
110,000	.....	.14	.....	
120,000	.....	.16	.....	
130,000	.....	.17	.....	
140,000	.....	.19	.....	
144,200	31,280	.....	.....	Tensile strength.
	30,880	.....	.....	Shearing strength of bolts.

Sheared the bolts.

No. 9402.

Marks, T7.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of web plate, $10''.18 \times ''.487$ ..... square inches . 4.96
Net sectional area of covers, $9''.17 \times ''.24$ ..... do 2.20

Gauged length, 15″.

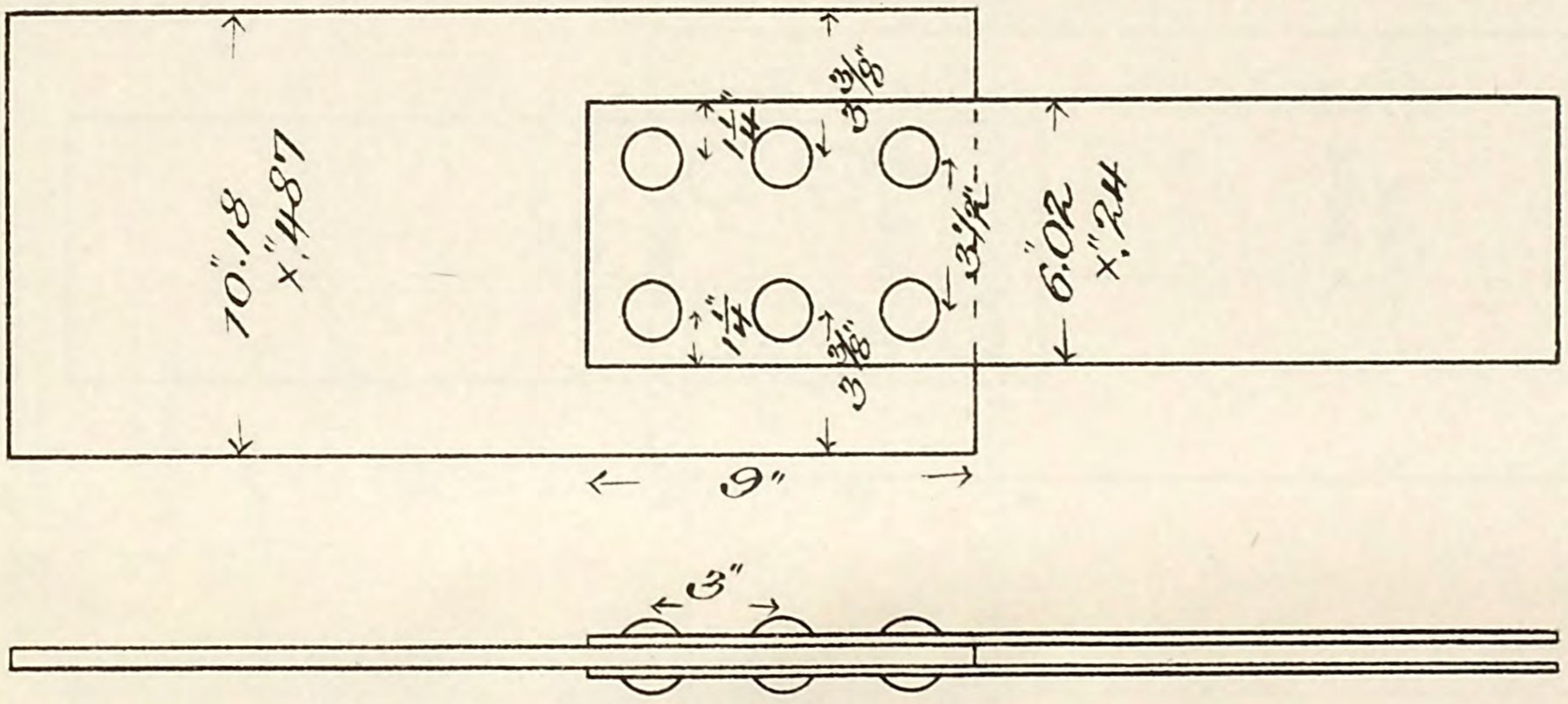
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load
1,000	.....	.0000	.....	
2,000	.....	.0002	.....	
4,000	.....	.0005	.....	
6,000	.....	.0007	.....	
8,000	.....	.0010	.....	
10,000	.....	.0014	.....	
12,000	.....	.0017	.....	
14,000	.....	.0021	.....	
16,000	.....	.0024	.....	
18,000	.....	.0027	.....	
20,000	.....	.0029	.....	
22,000	.....	.0032	.....	
24,000	.....	.0035	.....	
26,000	.....	.0037	.....	
28,000	.....	.0039	.....	
30,000	.....	.0043	.....	
32,000	.....	.0044	.....	
34,000	.....	.0048	.....	
36,000	.....	.0051	.....	
38,000	.....	.0054	.....	
40,000	.....	.0058	.0002	
42,000	.....	.0060	.....	
44,000	.....	.0063	.....	
46,000	.....	.0065	.....	
48,000	.....	.0069	.....	
50,000	.....	.0072	.....	
52,000	.....	.0075	.....	
54,000	.....	.0078	.....	
56,000	.....	.0081	.....	
58,000	.....	.0085	.....	
60,000	.....	.0087	.0007	
62,000	.....	.0090	.....	
64,000	.....	.0094	.....	
66.000	.....	.0097	.....	
68,000	.....	.0101	.....	
70,000	.....	.0106	.....	
72,000	.....	.0111	.....	
74,000	.....	.0120	.....	
76.000	.....	.0126	.....	
78,000	.....	.0131	.....	
80,000	.....	.0136	.....	
82,000	.....	.0143	.....	
84,000	.....	.0148	.....	
86,000	.....	.0152	.....	
88,000	.....	.0157	.....	
90,000	.....	.0161	.....	
92,000	.....	.0166	.....	
94,000	.....	.0170	.....	
96,000	.....	.0175	.....	
98,000	.....	.0180	.....	
100,000	.....	.0184	.0051	
102,000	.....	.0192	.....	
104,000	.....	.0196	.....	
106,000	.....	.0202	.....	
108,000	.....	.0207	.....	
110,000	.....	.0212	.....	
112,000	.....	.0219	.....	
114,000	.....	.0228	.....	
116,000	.....	.0238	.....	
118,000	.....	.0255	.....	
120,000	24,190	.03	.....	Tensile strength.

Fractured the covers through first row of rivet holes. Appearance granular next sides of holes, silky metal balance of fractures.

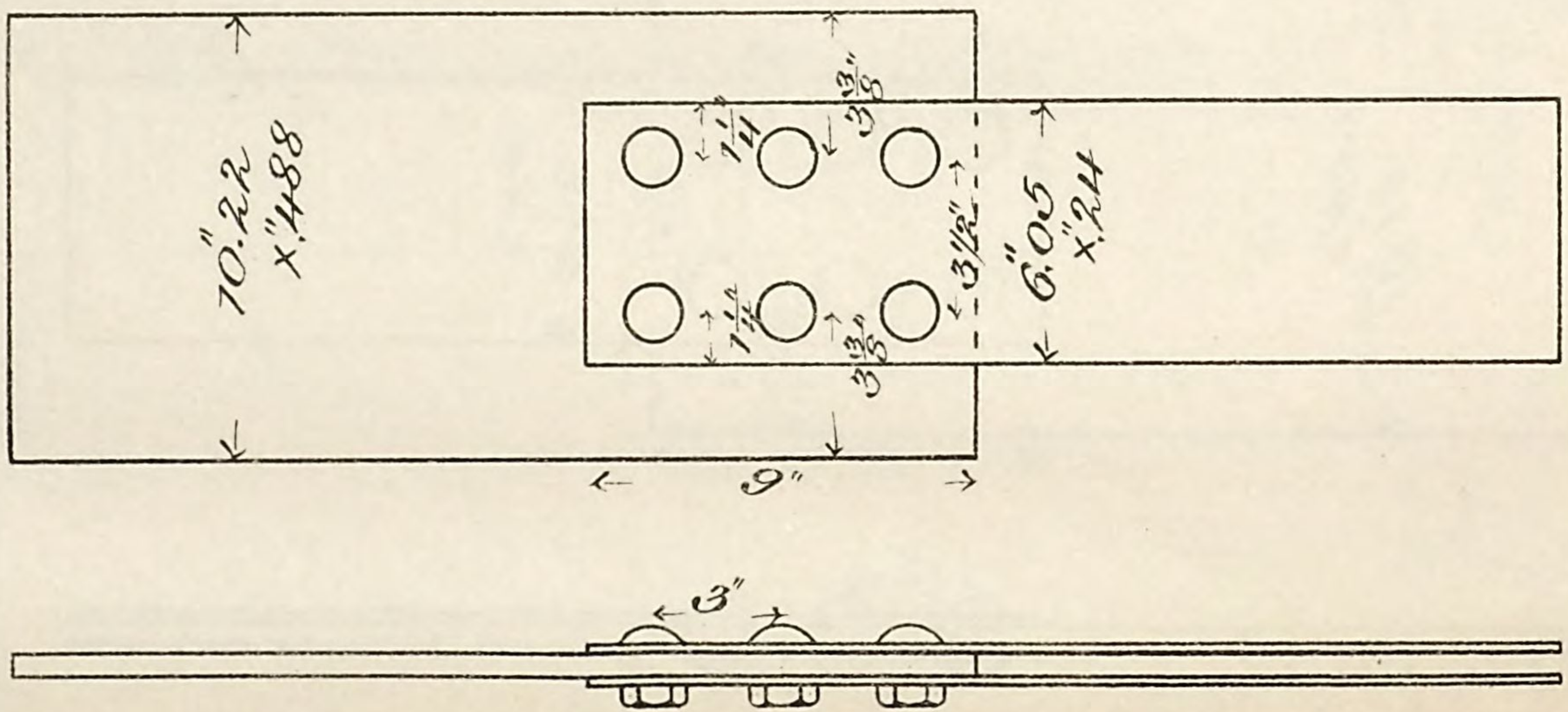
Maximum stress on joint.

Tension on gross section of web plate ..... pounds per square inch .. 24,190
Tension on net section of covers ..... do 54,540

No. 9402.



No. 9403.



No. 9403.

Marks, T 8.
$\frac{1}{2}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of web plate, 10".22 × ".488.....square inches.. 4.99
Shearing area of bolts, ".61 diameter .....do.... 3.50

Gauged length, 15".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0002	.....	
4,000	.....	.0005	.....	
6,000	.....	.0007	.....	
8,000	.....	.0010	.....	
10,000	.....	.0012	.....	
12,000	.....	.0015	.....	
14,000	.....	.0018	.....	
16,000	.....	.0021	.....	
18,000	.....	.0023	.....	
20,000	.....	.0026	.....	
22,000	.....	.0029	.....	
24,000	.....	.0032	.....	
26,000	.....	.0035	.....	
28,000	.....	.0041	.....	
30,000	.....	.05	.....	
40,000	.....	.08	.....	
50,000	.....	.12	.....	
60,000	.....	.15	.....	
70,000	.....	.17	.....	
80,000	.....	.19	.....	
90,000	.....	.21	.....	
100,000	.....	.26	.....	
103,500	20,740	.....	.....	Tensile strength.
	29,570	.....	.....	Shearing strength of bolts.

Sheared the bolts. Started fractures at sides of holes in first row in covers.

No. 9404.

Marks T 11.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of web plate, 10''.22 × ''.256 ..... square inch.. 2.62
Net sectional area of web plate, 8''.78 × ''.256 ..... do 2.25

Gauged length, 15''.

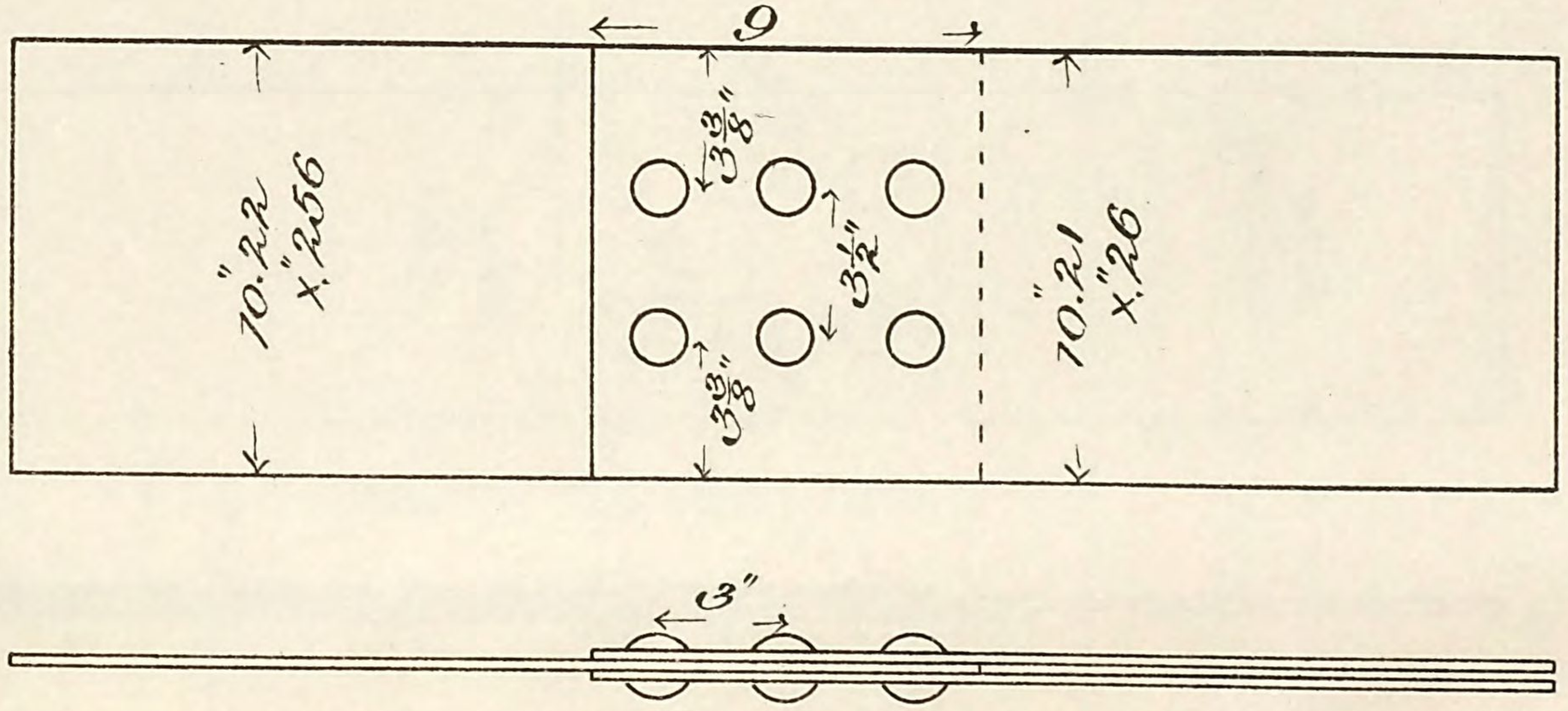
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0002	.....	
2,000	.....	.0003	.....	
4,000	.....	.0006	.....	
6,000	.....	.0009	.....	
8,000	.....	.0013	.....	
10,000	.....	.0017	.....	
12,000	.....	.0021	.....	
14,000	.....	.0025	.....	
16,000	.....	.0028	.....	
18,000	.....	.0032	.....	
20,000	.....	.0036	.....	
22,000	.....	.0039	.....	
24,000	.....	.0042	.....	
26,000	.....	.0046	.....	
28,000	.....	.0049	.....	
30,000	.....	.0052	.....	
32,000	.....	.0056	.....	
34,000	.....	.0059	.....	
36,000	.....	.0063	.....	
38,000	.....	.0067	.....	
40,000	.....	.0070	.0008	
42,000	.....	.0074	.....	
44,000	.....	.0079	.....	
46,000	.....	.0083	.....	
48,000	.....	.0086	.....	
50,000	.....	.0090	.....	
52,000	.....	.0095	.....	
54,000	.....	.0099	.....	
56,000	.....	.0104	.....	
58,000	.....	.0109	.....	
60,000	.....	.0114	.0023	
62,000	.....	.0121	.....	
64,000	.....	.0127	.....	
66,000	.....	.0134	.....	
68,000	.....	.0142	.....	
70,000	.....	.0149	.....	
72,000	.....	.0156	.....	
74,000	.....	.0164	.....	
76,000	.....	.0172	.....	
78,000	.....	.0179	.....	
80,000	.....	.0187	.0070	
82,000	.....	.0197	.....	
84,000	.....	.0204	.....	
86,000	.....	.0213	.....	
88,000	.....	.0223	.....	
90,000	.....	.0236	.....	
92,000	.....	.0249	.....	
94,000	.....	.0265	.....	
96,000	.....	.0288	.....	
98,000	.....	.05	.....	
109,900	41,950	.....	.....	Tensile strength.

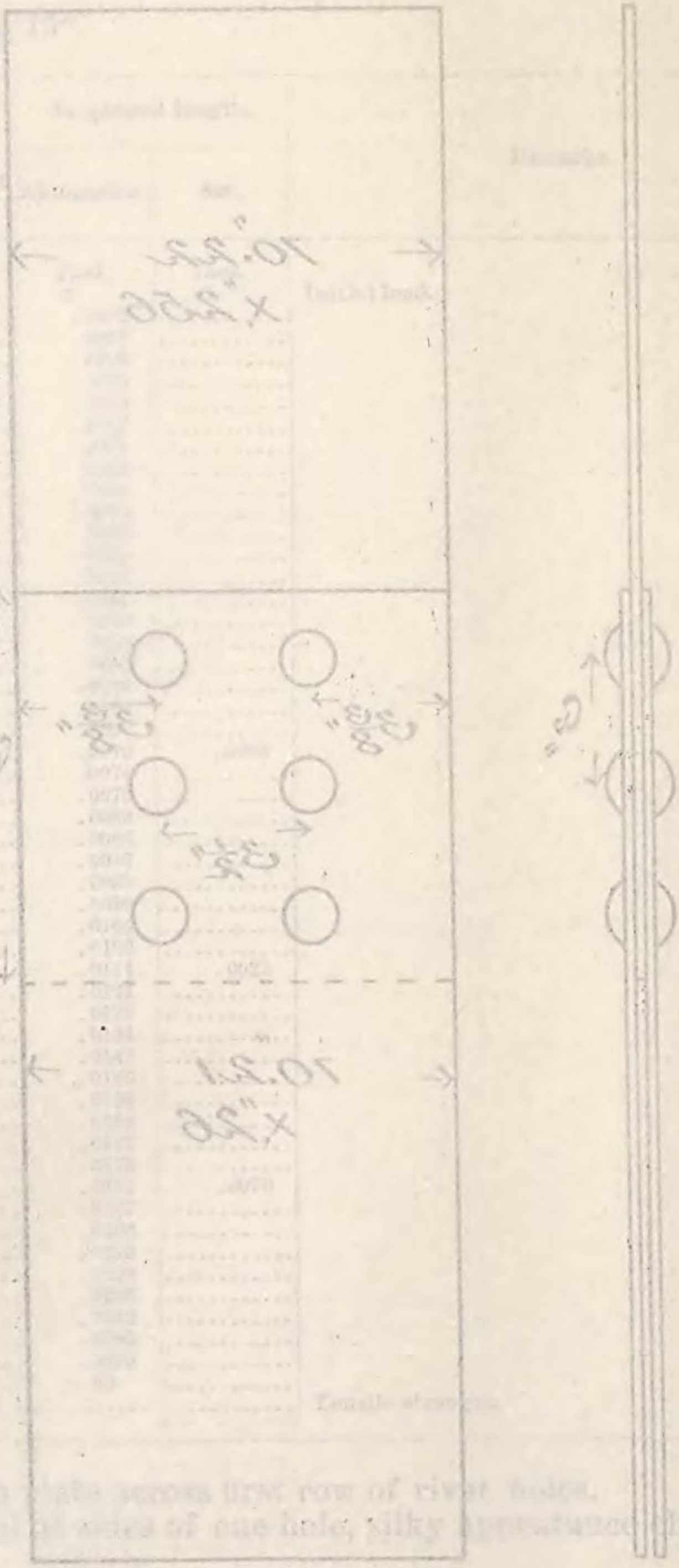
Fractured web plate across first row of rivet holes.
Granular metal at sides of one hole, silky appearance elsewhere.

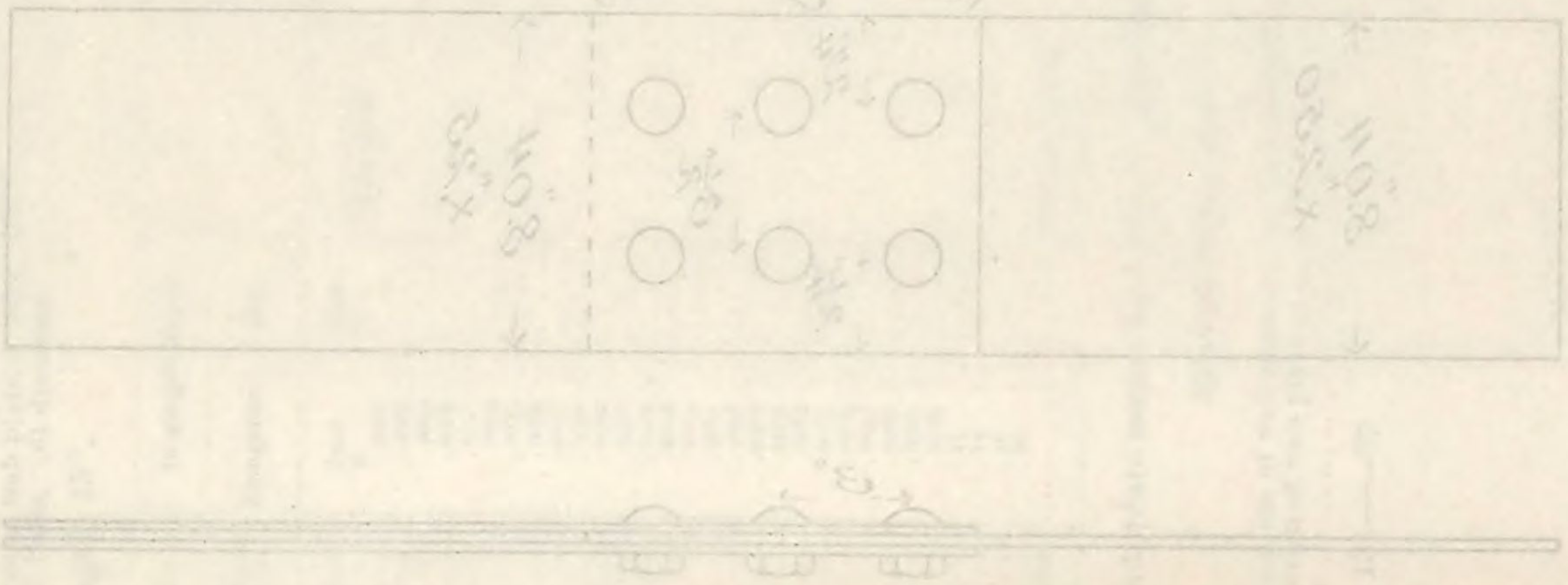
Maximum stress on joint.

Tension on gross section of web plate ..... pounds per square inch.. 41,950
Tension on net section of web plate ..... do 48,840

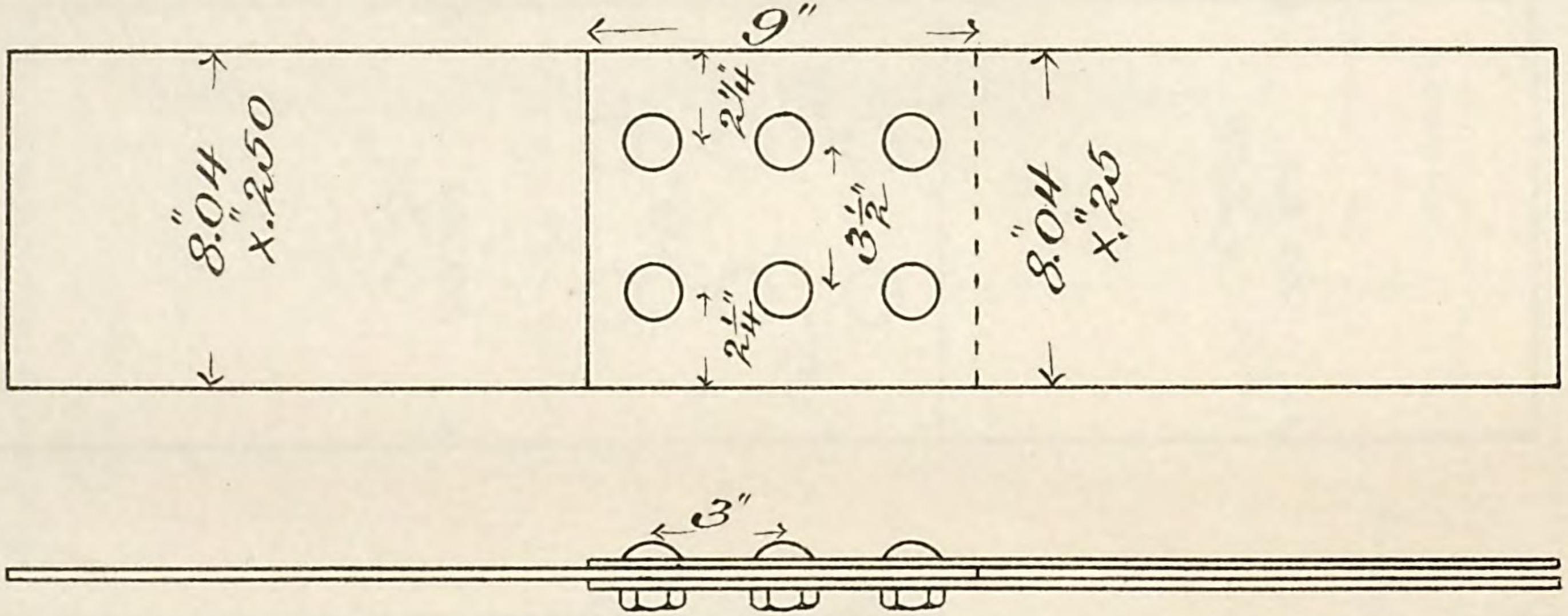
No. 9404.







No. 9405.



No. 9405.

Marks, T 12.
$\frac{1}{4}''$ steel plate, $\frac{5}{8}''$ iron bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of web plate, 8″.04×″.250	square inches	2.01
Net sectional area of web plate, 6″.60×″.250	do	1.65
Shearing area of bolts, ″.61 diameter	do	3.50

Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0001	.....	
2,000	.....	.0002	.....	
4,000	.....	.0005	.....	
6,000	.....	.0008	.....	
8,000	.....	.0011	.....	
10,000	.....	.0016	.....	
12,000	.....	.0020	.....	
14,000	.....	.0024	.....	
16,000	.....	.0027	.....	
18,000	.....	.0030	.....	
20,000	.....	.0034	.....	
22,000	.....	.0037	.....	
24,000	.....	.0040	.....	
26,000	.....	.0044	.....	
28,000	.....	.0048	.....	
30,000	.....	.0051	.....	
32,000	.....	.0056	.....	
34,000	.....	.0060	.....	
36,000	.....	.0064	.....	
38,000	.....	.0069	.....	
40,000	.....	.0072	.0008	
42,000	.....	.0076	.....	
44,000	.....	.0081	.....	
46,000	.....	.0085	.....	
48,000	.....	.0090	.....	
50,000	.....	.0098	.....	
52,000	.....	.11	.....	
60,000	.....	.14	.....	
70,000	.....	.16	.....	
80,000	.....	.30	.....	
80,400	40,000	.....	.....	Tensile strength.

Fractured web plate across first row of rivet holes. Silky.

Maximum stress on joint.

Tension on gross section of web plate	pounds per square inch	40,000
Tension on net section of web plate	do	48,730
Shearing on bolts	do	22.970

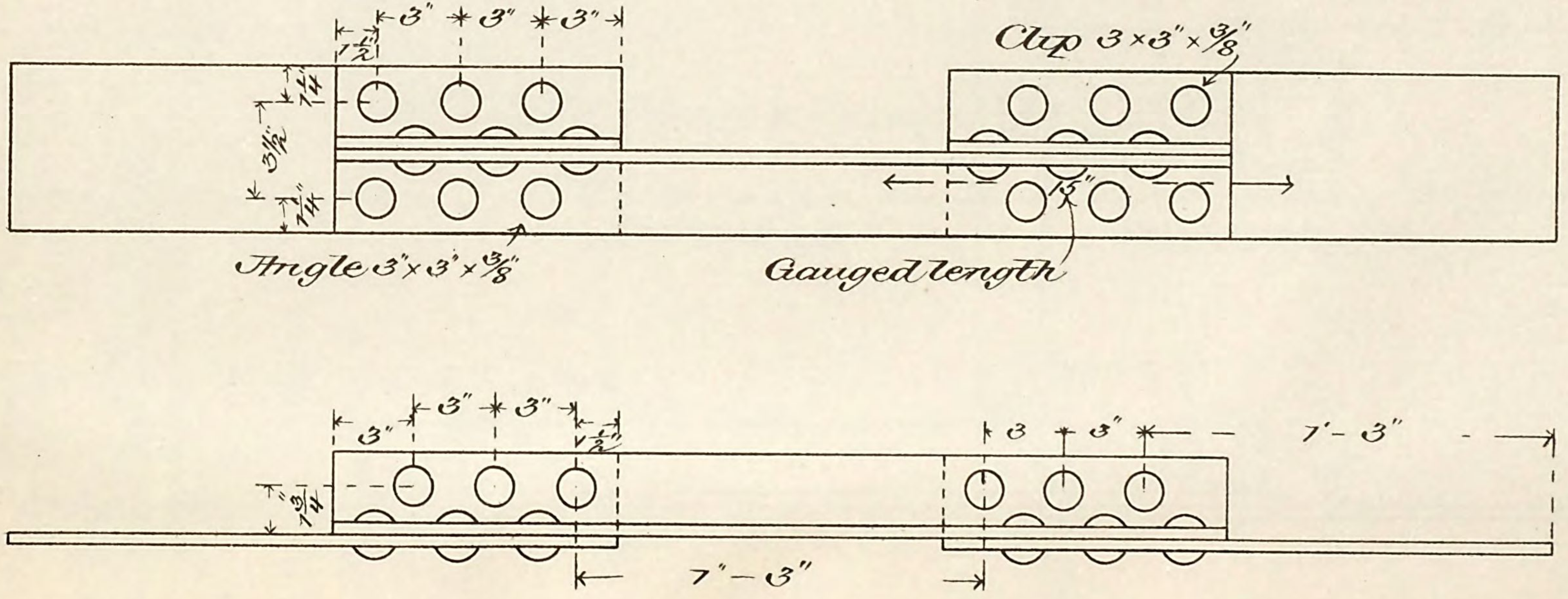
No. 9406.

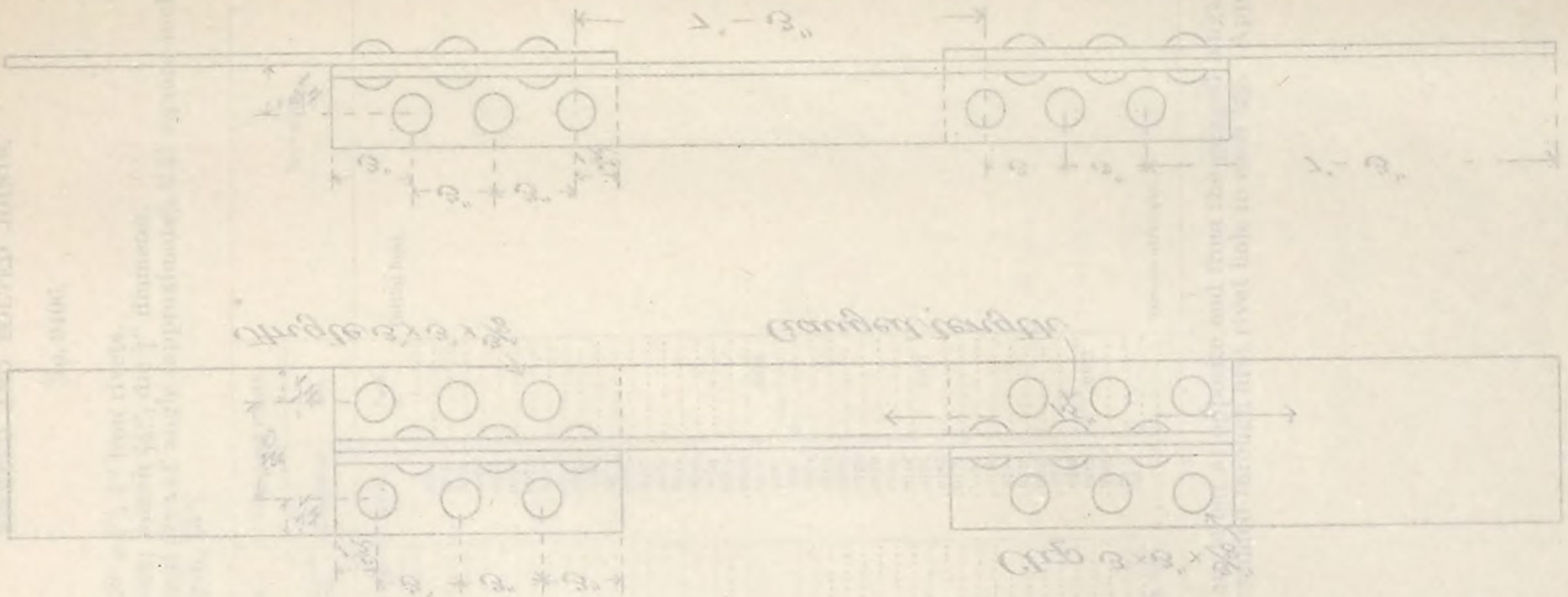
Marks, T 1.
Angle, $3'' \times 3'' \times \frac{3}{8}''$, $\frac{5}{8}''$ iron rivets.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.
Gross sectional area of angle (approximate), 2.11 square inches.
Gauged length, 15″.

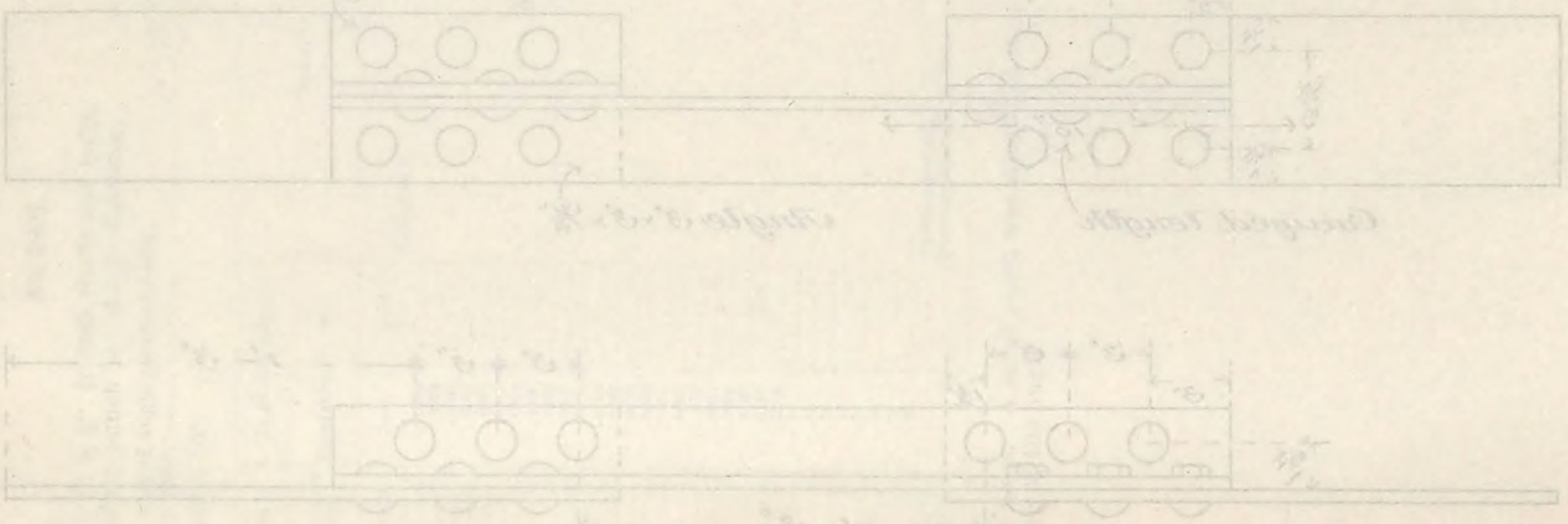
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	0.	.....	
1,500	.....	.0003	.....	
2,000	.....	.0005	.....	
2,500	.....	.0006	.....	
3,000	.....	.0008	.....	
4,000	.....	.0010	.....	
5,000	.....	.0012	.....	
6,000	.....	.0015	.....	
7,000	.....	.0017	.....	
8,000	.....	.0020	.....	
9,000	.....	.0022	.....	
10,000	.....	.0024	.....	
11,000	.....	.0027	.....	
12,000	.....	.0030	.....	
13,000	.....	.0035	.....	
14,000	.....	.0039	.....	
15,000	.....	.0044	.....	
16,000	.....	.0048	.....	
17,000	.....	.0054	.....	
18,000	.....	.0059	.....	
19,000	.....	.0066	.....	
20,000	.....	.0071	.0014	
21,000	.....	.0081	.....	
22,000	.....	.0087	.....	
23,000	.....	.0094	.....	
24,000	.....	.0104	.....	
25,000	.....	.0110	.....	
26,000	.....	.0120	.....	
27,000	.....	.0130	.....	
28,000	.....	.0138	.....	
29,000	.....	.0146	.....	
30,000	.....	.0154	.0051	
31,000	.....	.0165	.....	
32,000	.....	.0172	.....	
33,000	.....	.0180	.....	
34,000	.....	.0190	.....	
35,000	.....	.0199	.....	
36,000	.....	.0210	.....	
37,000	.....	.0222	.....	
38,000	.....	.0234	.....	
39,000	.....	.0246	.....	
40,000	.....	.0269	.0132	
41,000	.....	.0300	.....	
44,000	.....	.04	.....	
48,000	.....	.06	.....	
50,100	23,740	.....	.....	Tensile strength.

Fractured angle bar at opposite end from the gauged length. Line of fracture extended through first rivet hole in each leg. Appearance, granular.

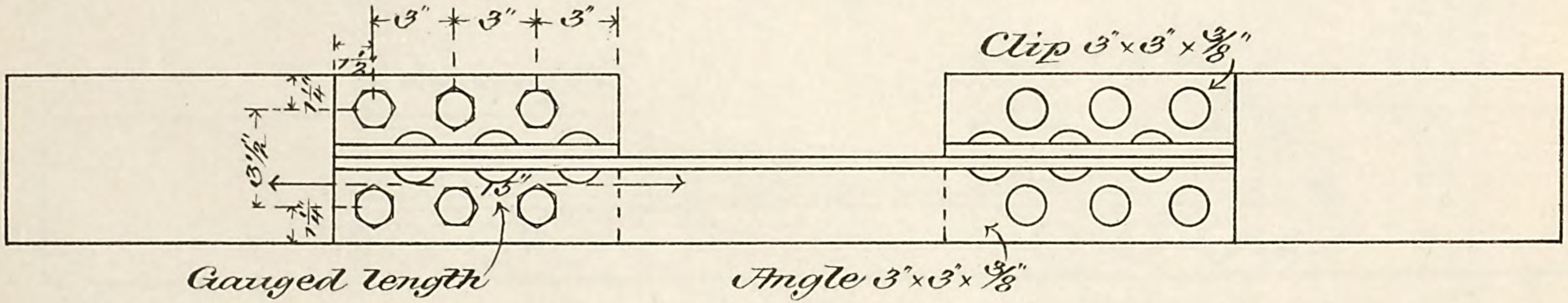
No. 9406.


3" 3" 3"
1½"
Clip 3×3"×⅜"
1¼"
3½"
¾"
15"
Angle 3"×3"×⅜"
Gauged length
3" 3" 3"
1½"
3 3" 3"
7'-3"
¾"
7"-3"





No. 9407



3"
3"
3"
1½"
1¼"
3½"
1¼"
15"
Clip 3"×3"×⅜"
Gauged length
Angle 3"×3"×⅜"
3"
3"
3"
1½"
1¾"
3"
3"
1'-3"
1'-3"

No. 9407.

Marks, T 2.
Angle, $3'' \times 3'' \times \frac{3}{8}'', \frac{5}{8}''$ iron rivets and bolts.
Punched holes; punch $\frac{11}{16}''$, die $\frac{3}{4}''$ diameter.

Gross sectional area of angle (approximate).....square inches.. 2.11
Shearing area of bolts.....do.... 1.75

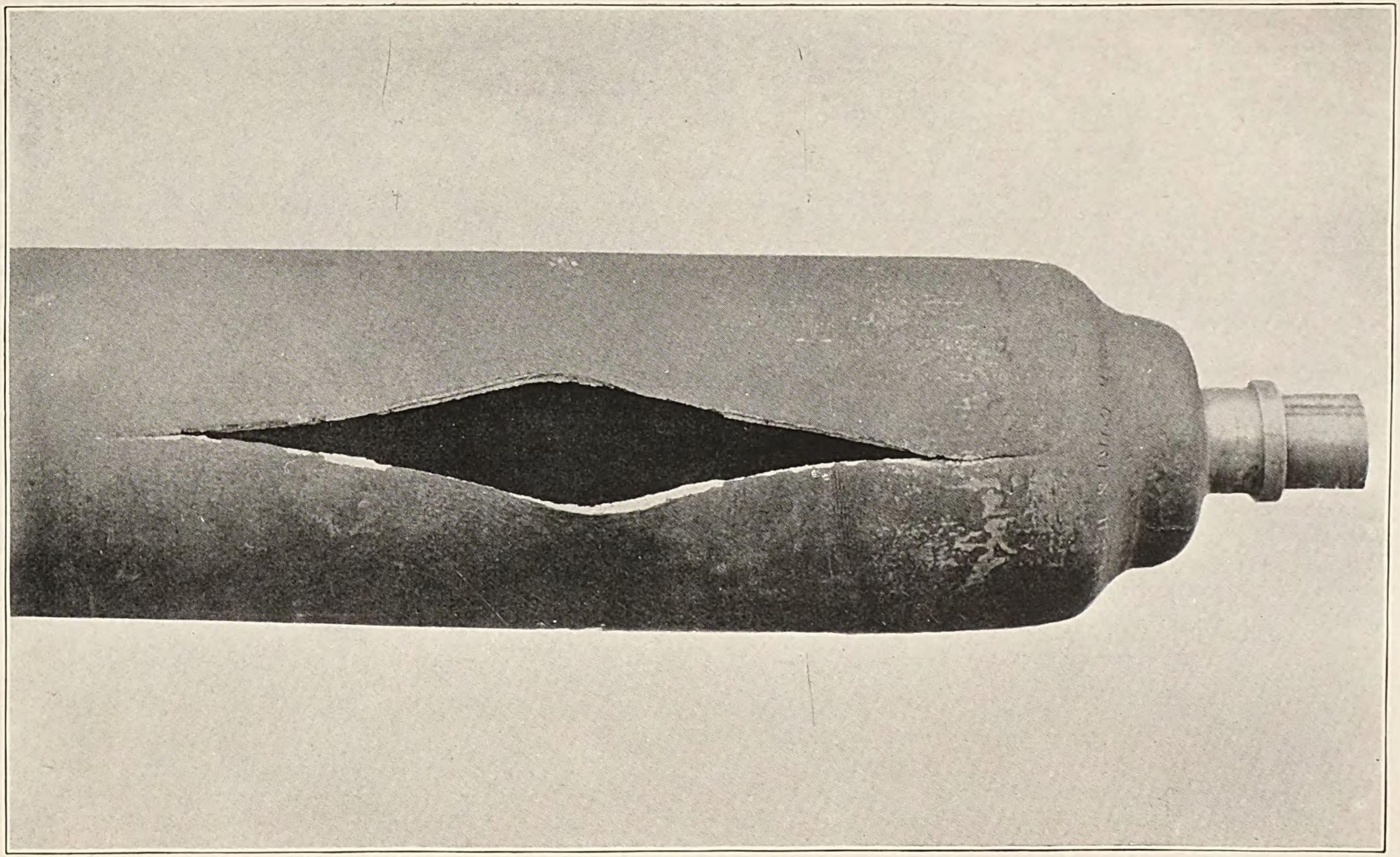
Gauged length, 15″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
500	.....	0.	0.	Initial load.
1,000	.....	.0002	.....	
1,500	.....	.0004	.....	
2,000	.....	.0005	.....	
2,500	.....	.0007	.....	
3,000	.....	.0009	.....	
4,000	.....	.0012	.....	
5,000	.....	.0016	.....	
6,000	.....	.0020	.....	
7,000	.....	.0024	.....	
8,000	.....	.0029	.....	
9,000	.....	.0033	.....	
10,000	.....	.0038	.....	
11,000	.....	.0044	.....	
12,000	.....	.0048	.....	
13,000	.....	.0052	.....	
14,000	.....	.0059	.....	
15,000	.....	.0066	.....	
16,000	.....	.0074	.....	
17,000	.....	.0083	.....	
18,000	.....	.0096	.....	
19,000	.....	.0120	.....	
20,000	.....	.0146	.0087	
21,000	.....	.0208	.....	
22,000	.....	.11	.....	
26,000	.....	.12	.....	
30,000	.....	.16	.....	
34,000	.....	.18	.....	
38,000	.....	.21	.....	
42,000	.....	.25	.....	
46,000	.....	.29	.....	
50,000	.....	.35	.....	
50,800	24,080	.....	.....	Tensile strength.
	29,030	.....	.....	Shearing strength of bolts.

Sheared the bolts. A small crack was started at the first rivet hole in the lower leg of the angle.

GAS TUBE.

HYDROSTATIC TEST, WITH INTERIOR PRESSURE, OF A GAS TUBE FOR THE UNITED STATES SIGNAL SERVICE.



PHOTOGRAPH SHOWING RUPTURE IN GAS TUBE AFTER THE TEST.

TUBE MADE BY THE MANNESMAN TUBE COMPANY, NEW YORK.

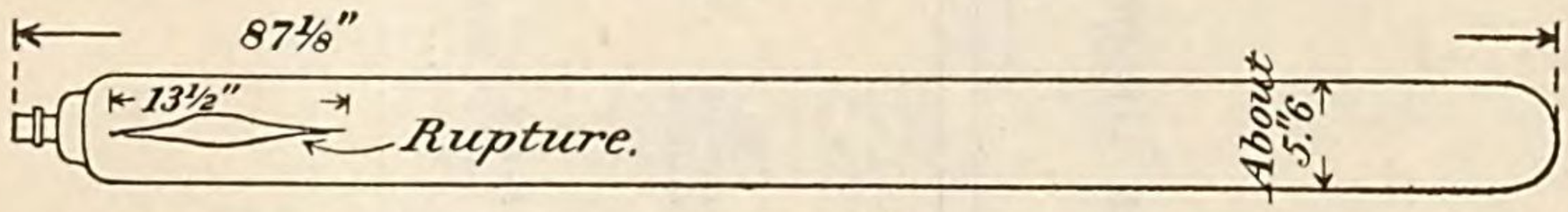
The tube was tested by means of piping connected with a reservoir cylinder placed in the testing machine. The piston of this reservoir was 3″.37 diameter; sectional area, 8.92 square inches.

The total loads applied refer to this piston. There was no leakage of the connections, hence the piston travel closely indicates the time when the tube reached its elastic limit, which occurred at 4,710 pounds per square inch, as shown by the increased rate of travel of the piston and the gradual yielding of the tube under sustained pressure.

Between the load at the elastic limit and time of final rupture, scale started off the exterior surface of the tube in minute flakes at places along its length, but without general scaling.

At a place 25″ to 31″ from the closed end a seam in the exterior surface slightly opened, this seam being about 90° from the side on which final rupture occurred.

No. 8312.



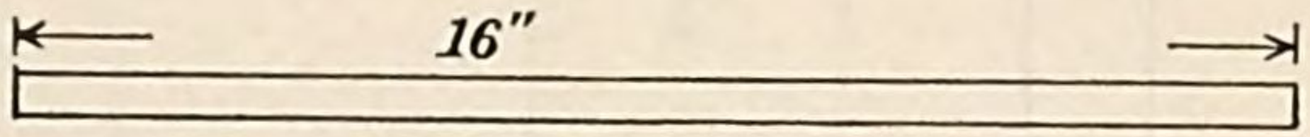
Weight, 82 pounds.

Applied loads.		Piston projects.	Remarks.
Total.	Per square inch.		
Pounds.	*Pounds.*	*Inches.*	
8,920	1,000	14.41	
17,840	2,000	13.53	
26,760	3,000	12.73	
35,680	4,000	11.95	
37,000	.....	11.83	
38,000	.....	11.75	
39,000	.....	11.65	
40,000	.....	11.54	
41,000	.....	11.42	
42,000	4,710	11.18	Elastic limit.
42,000	4,710	11.03	After 3 minutes.
42,000	4,710	10.94	After 5 minutes.
42,500	.....	10.83	
42,500	.....	10.46	Do.
43,000	.....	10.36	
43,000	.....	10.01	Do.
43,500	.....	9.90	
44,000	.....	9.75	
44,600	5,000	9.28	
44,600	5,000	8.19	Do.
46,000	.....	7.35	
47,000	.....	5.83	
47,500	.....	5.02	
48,000	.....	4.08	
49,000	.....	2.65	
8,920	1,000	16.76	New stroke of piston taken.
44,600	5,000	13.24	
49,000	.....	12.73	
50,000	.....	11.81	
51,000	.....	10.56	
52,000	.....	9.40	
52,300	5,863	.....	Ultimate strength.

A longitudinal rupture occurred at the nipple end of the tube, extending about 13½″ along the length of the tube.

Appearance silky, lamellar.

WROUGHT-IRON BARS FROM BERLIN IRON BRIDGE COMPANY.

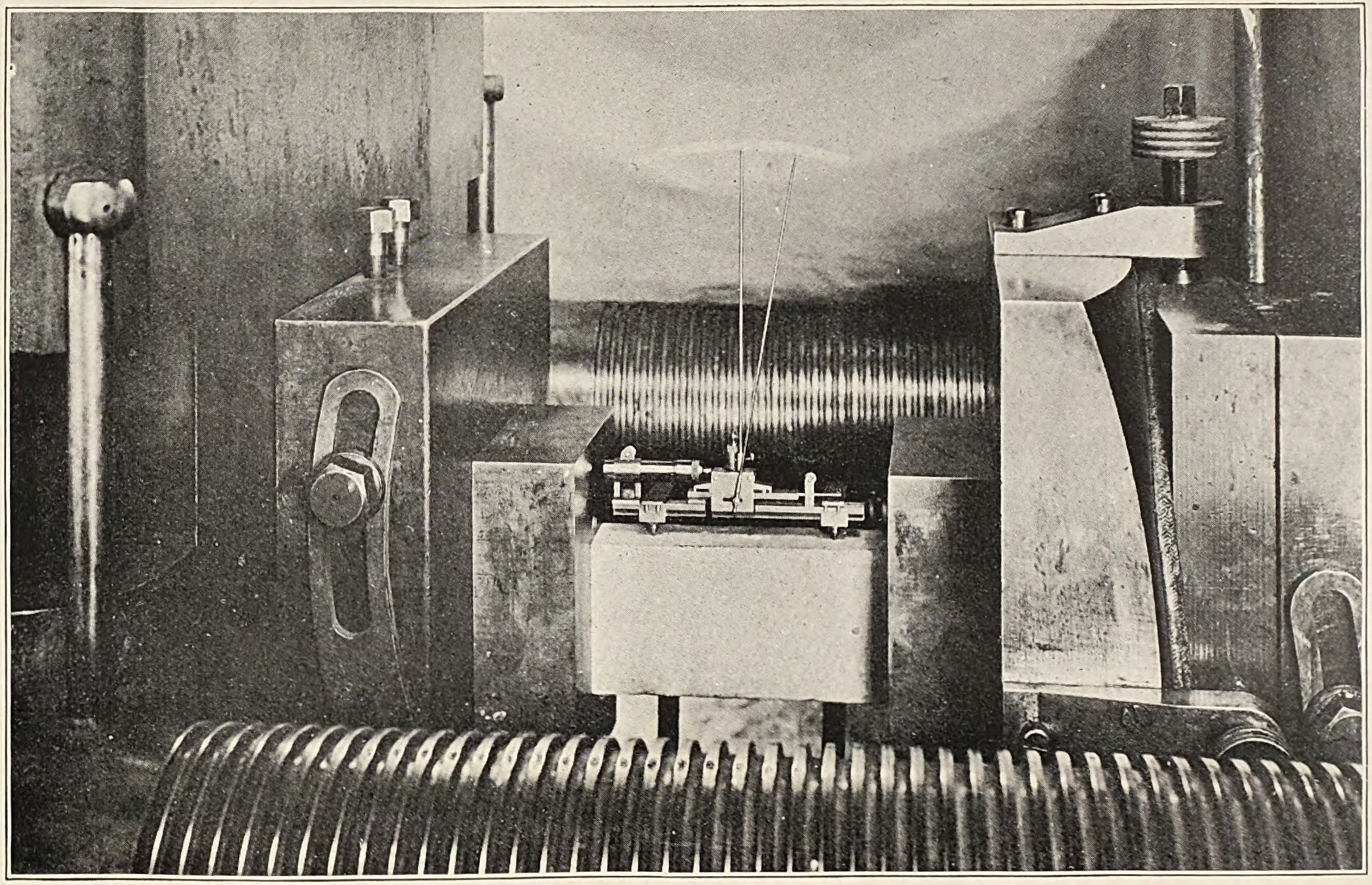


No. of test.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
			Total.	Per square inch.	Total.	Per square inch.	Inches.	Per cent.				
	Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*			*Inch. Sq. in.*	*Per ct.*		" " " " " " " "
9345	.58	.264	9,750	36,930	14,280	54,090	1.87	23.4	Diam., .42 = .139	47.3	Fibrous	.16, .21, .21, .21, .48, .22, .20, .18
9346	.58	.264	10,200	38,640	14,310	54,200	1.96	24.5	Diam., .45 = .159	39.8	do	.17, .21, .22, .22, .23, .25, .40*, .26

BRICKS.

ABSORPTION OF WATER AND COMPRESSIVE ELASTIC PROPERTIES, AND EXPANSION DUE TO HEAT AND COLD.

BUILDING MATERIAL TESTS, CONTINUED FROM REPORT OF 1895.



THE ELASTIC PROPERTIES OF BRICKS.

PHOTOGRAPH SHOWING MICROMETER IN POSITION ON BRICK FOR MEASURING THE COMPRESSIONS.

BRICKS.

Absorption of Water.

No. of test compressive elastic properties.	Contributor.	Weight, dry.		Absorption of water.					
				After soaking one week.		After passing through cold, hot and cold baths.		Increase after soaking first week.	
				By weight.	By volume.	By weight.	By volume.	By weight.	By volume.
		Lbs.	*Oz.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
1373	Kansas City Hydraulic Press Brick Co	5	7	12.1	23.0	14.1	26.8	2.0	3.8
1374	....do	5	6¼	10.7	20.6	13.0	25.1	2.3	4.5
1378	The Powhatan Clay Manufacturing Co	5	¼	11.2	20.9	14.3	26.7	3.1	5.8
1377	....do	4	10¾	6.7	14.4	8.4	18.0	1.7	3.6
1370	The Hydraulic Press Brick Co	5	¼	15.9	28.2	18.1	32.0	2.2	3.8
1371	....do	5	9½	7.5	15.3	11.4	23.2	3.9	7.9
1372	....do	5	11½	9.0	17.7	12.0	23.7	3.0	6.0
1381	Philadelphia and Boston Face Brick Co	5	3½	19.5	33.1	21.2	36.2	1.7	3.1
1382	....do	5	6½	17.6	31.0	19.3	34.0	1.7	3.0
1386	....do	5	1¼	4.6	10.2	6.2	13.6	1.6	3.4
1384	....do	4	5	17.7	29.8	21.0	35.3	3.3	5.5
1385	....do	4	15½	10.7	21.1	12.6	24.8	1.9	3.7
1365	Eastern Hydraulic Press Brick Co	5	7½	7.1	14.8	8.5	17.8	1.4	3.0
1366	....do	5	4½	7.4	14.4	9.2	18.7	1.8	4.3
1367	....do	5	6½	6.1	12.6	8.4	17.4	2.3	4.8
1375	Brooke Terra Cotta Co	5	14½	6.6	13.0	10.8	21.3	4.2	8.3
1376	....do	5	15¼	5.5	11.4	8.1	16.9	2.6	5.5
1380	Gladding McBean & Co	5	10½	5.8	12.0	10.2	21.2	4.4	9.2
1379	....do	5	10¼	11.6	22.6	13.6	26.3	2.0	3.7
1364	Northern Hydraulic Press Brick Co	5	5¼	13.5	24.9	15.8	29.2	2.3	4.3
1368	Chicago Hydraulic Press Brick Co	5	4¾	9.4	19.0	10.9	22.0	1.5	3.0
1363	Clark Press Brick Co	5	8	7.7	14.1	13.1	24.1	5.4	10.0

Compressive Elastic Properties.

The bricks were prepared for testing with their ends ground flat, and were loaded endwise in the testing machine.

Observations were made on the compressibility of the bricks in the direction of loading, and the lateral expansion of the material was determined on a transverse gauged length taken at right angles to the direction of loading.

Values of the moduli of elasticity ranged from 820,000 pounds per square inch for a soft fire brick to 7,200,000 pounds per square inch the value found for a hard paving brick.

The ratios of lateral expansion to longitudinal compression generally fell between the limits of $\frac{1}{4.9}$ and $\frac{1}{10.8}$. In one instance the apparent ratio was $\frac{1}{1.9}$, but this exceptionally large value was attributable to the heterogeneous condition of the brick, which was softer and more compressible immediately under the transverse gauged length than elsewhere along its length.

An exceptionally small ratio, $\frac{1}{31.7}$, was shown by a fire brick of low compressive modulus of elasticity.

The coefficients of expansion by heat were determined with certain bricks which had been examined for compressive elastic properties and reported in 1895.

The absorption of water was observed after one week's immersion in a bath at atmospheric temperature, and was again observed after the brick had passed through the hot water bath of about 212° F.

The effects of freezing while in a saturated state were determined showing the expansion while in a frozen state and the permanent set which resulted from this expansion. A number of samples were frozen a second time.

The following table exhibits these results, together with moduli of elasticity and ratios of lateral expansion and longitudinal compression.

When a second freezing had been given the brick, the second values in the column showing the expansion by freezing indicate the total amount of expansion in the gauged length of 6″.

Brick Contributed by the Somerset and Johnsonburg Manufacturing Company, Boston, Mass.

PAVING BRICK, DARK BROWN COLOR.

No. 1393.

Length, 8″.59.
Sectional area, 2″.56 × 4″.22 = 10.8.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,080	100	0.	0.	Initial load.
2,160	200	.0001	.....	
3,240	300	.0002	.....	
4,320	400	.0003	.....	
5,400	500	.0004	.....	
6,480	600	.0005	.....	
7,560	700	.00 6	.....	
8,640	800	.0008	.....	
9,720	900	.0009	.....	
10,800	1,000	.0011	.....	
1,080	100	.....	0.	
16,200	1,500	.0018	.....	
21,600	2,000	.0025	.....	
27,000	2,500	.0033	.....	
32,400	3,000	.0039	.....	
37,800	3,500	.0047	.....	
43,200	4,000	.0054	.....	
48,600	4,500	.0062	.....	
54,000	5,000	.0069	.....	E = 3,650,000 pounds per square inch.
1,080	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,080	100	0.	0.	Initial load.
54,000	5,000	.0007	.....	
1,080	100	.....	0.	
54,000	5,000	.0007	.....	
1,080	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.7}$.

Bricks Contributed by the Gay Head Clay and Brick Company, Chelsea, Mass.

FIRE BRICK, "SALAMANDER XX."

No. 1400.

Length, 9″.10.
Sectional area, 2″.50 × 4″.60 = 11.50 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,150	100	0.	0.	Initial load.
2,300	200	.0006	.....	
3,450	300	.0011	.....	
4,600	400	.0016	.....	
5,750	500	.0022	.....	
6,900	600	.0028	.....	
8,050	700	.0033	.....	
9,200	800	.0039	.....	
10,350	900	.0044	.....	
11,500	1,000	.0050	.....	E = 980,000 pounds per square inch.
1,150	100	.....	.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,150	100	0.	0.	Initial load.
11,500	1,000	.0001	.....	
1,150	100	.....	0.	
11,500	1,000	.0001	.....	
1,150	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{31.7}$.

DARK BUFF SPECKLED BRICK.

No. 1444.

Length, 11″.78.
Sectional area, 1″.56 × 4″.03 = 6.29 square inches.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
629	100	0.	0.	Initial load.
1,258	200	.0004	.....	
1,887	300	.0007	.....	
2,516	400	.0010	.....	
3,145	500	.0012	.....	
3,774	600	.0015	.....	
4,403	700	.0018	.....	
5,032	800	.0021	.....	
5,661	900	.0023	.....	
6,290	1,000	.0027	.....	
629	100	.....	0.	
9,435	1,500	.0040	.....	
12,580	2,000	.0055	.....	
15,725	2,500	.0069	.....	
18,870	3,000	.0083	.....	E = 2,180,000 pounds per square inch.
629	100	.....	.0003	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
629	100	0.	0.	Initial load.
18,870	3,000	.0009	.....	
629	100	.....	0.	
18,870	3,000	.0009	.....	
629	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.2}$.

DARK BUFF SPECKLED BRICK.

No. 1445.

Length, 11″.75.
Sectional area, 1″.55 × 4″.03 = 6.25 square inches.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
625	100	0.	0.	Initial load.
1,250	200	.0002	.....	
1,875	300	.0006	.....	
2,500	400	.0009	.....	
3,125	500	.0012	.....	
3,750	600	.0014	.....	
4,375	700	.0017	.....	
5,000	800	.0020	.....	
5,625	900	.0022	.....	
6,250	1,000	.0025	.....	
625	100	.....	0.	
9,375	1,500	.0039	.....	
12,500	2,000	.0052	.....	
15,625	2,500	.0065	.....	
18,750	3,000	.0080	.....	E = 2,260,000 pounds per square inch.
625	100	.....	.0003	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
625	100	0.	0.	Initial load.
18,750	3,000	.0006	.....	
625	100	.....	0.	
18,750	3,000	.0006	.....	
625	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.5}$.

Brick Contributed by the Blandford Brick and Tile Company, Russell, Mass.

FIRE BRICK No. 1. X.

No. 1399.

Length, 9″.19.
Sectional area, 2″.43 × 4″.84 = 11.76 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,176	100	0.	0.	Initial load.
2,352	200	.0007	.....	
3,528	300	.0013	.....	
4,704	400	.0019	.....	
5,880	500	.0025	.....	
7,056	600	.0031	.....	
8,232	700	.0035	.....	
9,408	800	.0040	.....	
10,584	900	.0046	.....	
11,760	1,000	.0052	.....	E = 940,000 pounds per square inch.
1,176	100	.....	.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,176	100	0.	0.	Initial load.
11,760	1,000	.0004	.....	
1,176	100	.....	0.	
11,760	1,000	.0004	.....	
1,176	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8.4}$.

Brick Contributed by the New England Steam Brick Company, Providence, R. I.

PAVING BRICK, DARK RED COLOR.

No. 1395.

Length, 7″.75.
Sectional area, 2″.35 × 3″.55 = 8.34 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
834	100	0.	0.	Initial load.
4,170	500	.0002	.....	
8,340	1,000	.0007	.....	
12,510	1,500	.0014	.....	
16,680	2,000	.0020	.....	
20,850	2,500	.0026	.....	
25,020	3,000	.0032	.....	
29,190	3,500	.0039	.....	
33,360	4,000	.0045	.....	
37,530	4,500	.0050	.....	
41,700	5,000	.0056	.....	E = 4,540,000 pounds per square inch.
834	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.

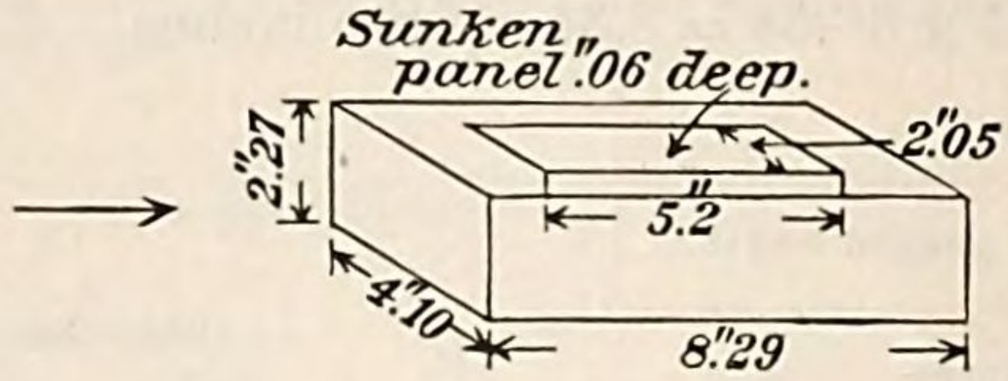
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
834	100	0.	0.	Initial load.
41,700	5,000	.0004	.....	
834	100	.....	0.	
41,700	5,000	.0004	.....	
834	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{8.1}$.

Bricks Contributed by the Sayre & Fisher Company, Sayreville, N. J.

CREAM-COLORED BRICK No. 3.

No. 1397.



Sectional area $(2''.27 \times 4''.10) - (''.06 \times 2''.05) = 9.18$ square inches.
Gauged length 5″, on opposite side to sunken panel.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
918	100	0.	0.	Initial load.
1,836	200	.0004	.....	
2,754	300	.0007	.....	
3,672	400	.0010	.....	
4,590	500	.0012	.....	
5,508	600	.0014	.....	
6,126	700	.0016	.....	
7,344	800	.0018	.....	
8,262	900	.0021	.....	
9,180	1,000	.0023	.....	
918	100	.....	.0002	
13,770	1,500	.0034	.....	
18,360	2,000	.0045	.....	
22,950	2,500	.0056	.....	
27,540	3,000	.0068	.....	
32,130	3,500	.0080	.....	
35,600	3,878	.....	.....	Cracks.
38,580	4,203	.....	.....	Ultimate strength.

BRICK No. 47.

No. 1446.

Length, 11.″79.
Sectional area, 1″.58 × 3″.96 = 6.26 square inches.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
626	100	0.	0.	Initial load.
1,252	200	.0000	.....	
1,878	300	.0002	.....	
2,504	400	.0004	.....	
3,130	500	.0007	.....	
3,756	600	.0010	.....	
4,382	700	.0013	.....	
5,008	800	.0016	.....	
5,634	900	.0019	.....	
6,260	1,000	.0023	.....	
626	100	.....	0.	
9,390	1,500	.0039	.....	
12,520	2,000	.0057	.....	
15,650	2,500	.0078	.....	
18,780	3,000	.0105	.....	E = 1,790,000 pounds per square inch.
626	100	.....	.0008	
18,780	3,000	.0109	.....	
626	100	.....	.0009	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
626	100	0.	0.	Initial load.
18,780	3,000	.0029	.....	
626	100	.....	.0001	
18,780	3,000	.0033	.....	
626	100	.....	.0003	

Brick began to crack in that part covered by the micrometer.
Ratio of lateral expansion to longitudinal compression, $\frac{1}{1.9}$.

BRICK No. 44.

No. 1447.

Length, 11″.88.
Sectional area, 1″.55 × 3″.97 = 6.15 square inches.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
615	100	0.	0.	Initial load.
1,230	200	.0002	.....	
1,845	300	.0003	.....	
2,460	400	.0005	.....	
3,075	500	.0007	.....	
3,690	600	.0010	.....	
4,305	700	.0012	.....	
4,920	800	.0014	.....	
5,535	900	.0016	.....	
6,150	1,000	.0019	.....	
615	100	.....	.0001	
9,225	1,500	.0031	.....	
12,300	2,000	.0043	.....	
15,375	2,500	.0054	.....	
18,450	3,000	.0066	.....	E = 2,760,000 pounds per square inch.
615	100	.....	.0003	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
615	100	0.	0.	Initial load.
18,450	3,000	.0005	.....	
615	100	.....	0.	
18,450	3,000	.0005	.....	
615	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.3}$.

BRICK No. 30.

No. 1448.

Length, 11″.93.
Sectional area, 1″.51 × 4″.06 = 6.13 square inches.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
613	100	0.	0.	Initial load.
1,226	200	.0002	.....	
1,839	300	.0005	.....	
2,452	400	.0008	.....	
3,065	500	.0012	.....	
3,678	600	.0015	.....	
4,291	700	.0018	.....	
4,904	800	.0021	.....	
5,517	900	.0025	.....	
6,130	1,000	.0028	.....	
613	100	.....	.0002	
9,195	1,500	.0044	.....	
12,260	2,000	.0062	.....	E = 1,960,000 pounds per square inch.
613	100	.....	.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
613	100	0.	0.	Initial load.
12,260	2,000	.0005	.....	
613	100	.....	0.	
12,260	2,000	.0005	.....	
613	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.7}$.

Bricks Contributed by the Franklin Paving Brick Company, Franklin, Pa.

PAVING BRICK, DARK RED COLOR.

No. 1391.

Length, 8″.22.
Sectional area, 2″.50×4″.15=10.38 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,038	100	0.	0.	Initial load.
2,076	200	.0001	.....	
3,114	300	.0002	.....	
4,152	400	.0004	.....	
5,190	500	.0005	.....	
6,228	600	.0006	.....	
7,266	700	.0007	.....	
8,304	800	.0008	.....	
9,342	900	.0009	.....	
10,380	1,000	.0010	.....	
1,038	100	.....	0.	
15,570	1,500	.0014	.....	
20,760	2,000	.0017	.....	
25,950	2,500	.0021	.....	
31,140	3,000	.0025	.....	
36,330	3,500	.0030	.....	
41,520	4,000	.0034	.....	
46,710	4,500	.0037	.....	
51,900	5,000	.0041	.....	
1,038	100	.....	.0001	
62,280	6,000	.0048	.....	
72,660	7,000	.0056	.....	
83,040	8,000	.0064	.....	
93,420	9,000	.0071	.....	
103,800	10,000	.0080	.....	E=6,350,000 pounds per square inch.
83,040	8,000	.0065	.....	
62,280	6,000	.0050	.....	
41,520	4,000	.0035	.....	
20,760	2,000	.0020	.....	
10,380	1,000	.0011	.....	
1,038	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,038	100	0.	0.	Initial load.
103,800	10,000	.0008	.....	
1,038	100	.....	0.	
103,800	10,000	.0008	.....	
1,038	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.8}$.

PAVING BRICK, DARK BROWN COLOR.

No. 1392.

Length, 8″.14.
Sectional area, 2″.46 × 4″.18=10.28 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,028	100	0.	0.	Initial load.
2,056	200	.0001	.....	
3,084	300	.0002	.....	
4,112	400	.0003	.....	
5,140	500	.0004	.....	
6,168	600	.0005	.....	
7,196	700	.0006	.....	
8,224	800	.0006	.....	
9,252	900	.0007	.....	
10,280	1,000	.0008	.....	
1,028	100	.....	0.	
15,420	1,500	.0012	.....	
20,560	2,000	.0015	.....	
25,700	2,500	.0019	.....	
30,840	3,000	.0023	.....	
35,980	3,500	.0026	.....	
41,120	4,000	.0029	.....	
46,260	4,500	.0033	.....	
51,400	5,000	.0036	.....	
1,028	100	.....	0.	
61,680	6,000	.0043	.....	
71,960	7,000	.0049	.....	
82,240	8,000	.0057	.....	
92,520	9,000	.0064	.....	
102,800	10,000	.0071	.....	} E=7,070,000 pounds per square inch.
1,028	100	.....	.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,028	100	0.	0.	Initial load.
102,800	10,000	.0008	.....	
1,028	100	.....	0.	
102,800	10,000	.0008	.....	
1,028	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.1}$.

Brick Contributed by The Powhatan Clay Manufacturing Company, Richmond, Va.

CREAM-WHITE COLORED BRICK.

No. 1443.

Length, 11″.66.
Sectional area, 2″.39×3″.79=9.06 square inches.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
906	100	0.	0.	Initial load.
1,812	200	.0004	.....	
2,718	300	.0007	.....	
3,624	400	.0011	.....	
4,230	500	.0015	.....	
5,436	600	.0019	.....	
6,342	700	.0024	.....	
7,248	800	.0028	.....	
8,154	900	.0032	.....	
9,060	1,000	.0036	.....	
906	100	.....	.0003	
13,590	1,500	.0058	.....	
18,120	2,000	.0080	.....	
22,650	2,500	.0101	.....	
27,180	3,000	.0123	.....	E=2,480,000 pounds per square inch.
906	100	.....	.0006	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
906	100	0.	0.	Initial load.
27,180	3,000	.0008	.....	
906	100	.....	0.	
27,180	3,000	.0008	.....	
906	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.1}$.

Brick Contributed by John Eharker, Ashby, Ala.

FIRE BRICK.

No. 1398.

Length, 9″.04.
Sectional area, 2″.60 × 4″.28 = 11.13 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,113	100	0.	0.	Initial load.
2,226	200	.0007	.....	
3,339	300	.0013	.....	
4,452	400	.0021	.....	
5,565	500	.0028	.....	
6,678	600	.0035	.....	
7,791	700	.0041	.....	
8,904	800	.0047	.....	
10,017	900	.0054	.....	
11,130	1,000	.0061	.....	
1,113	100	.....	.0006	
12,243	1,100	.0069	.....	
13,556	1,200	.0075	.....	
14,469	1,300	.0081	.....	
15,582	1,400	.0087	.....	
16,695	1,500	.0095	.....	E = 820,000 pounds per square inch.
1,113	100	.....	.0010	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,113	100	0.	0.	Initial load.
16,695	1,500	.0006	.....	
1,113	100	.....	0.	
16,695	1,500	.0006	.....	
1,113	100	.....	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{10.8}$.

Brick Contributed by The A. O. Jones Brick and Terra Cotta Company, Zanesville, Ohio.

PAVING BRICK, DARK BROWN COLORED

No. 1394.

Length, 7″.89.
Sectional area, 2″.58 × 3″.89 = 10.04 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,004	100	0.	0.	Initial load.
2,008	200	.0001	.....	
3,012	300	.0004	.....	
4,016	400	.0006	.....	
5,020	500	.0008	.....	
6,024	600	.0010	.....	
7,028	700	.0011	.....	
8,032	800	.0012	.....	
9,036	900	.0013	.....	
10,040	1,000	.0014	.....	
1,004	100	.....	0.	
15,060	1,500	.0020	.....	
20,080	2,000	.0025	.....	
25,100	2,500	.0031	.....	
30,120	3,000	.0036	.....	
35,140	3,500	.0041	.....	
40,160	4,000	.0045	.....	
45,180	4,500	.0050	.....	
50,200	5,000	.0056	.....	
1,004	100	.....	0.	
55,220	5,500	.0061	.....	
60,240	6,000	.0066	.....	E = 4,540,000 pounds per square inch.
1,004	100	.....	.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,004	100	0.	0.	Initial load.
60,240	6,000	.0008	.....	
1,004	100	.....	0.	
60,240	6,000	.0008	.....	
1,004	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.6}$.

Brick Contributed by the Kelley Brick and Tile Company, Minneapolis, Minn.

LIGHT BUFF COLORED BRICK.

No. 1396.

Length, 7″.64.
Sectional area, 2″.36 × 3″.68 = 8.68 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
868	100	0.	0.	Initial load.
1,736	200	.0002	.....	
2,604	300	.0004	.....	
3,472	400	.0006	.....	
4,340	500	.0008	.....	
5,208	600	.0010	.....	
6,076	700	.0012	.....	
6,944	800	.0014	.....	
7,812	900	.0016	.....	
8,680	1,000	.0018	.....	
868	100	.....	0.	
13,020	1,500	.0027	.....	
17,360	2,000	.0037	.....	
21,700	2,500	.0048	.....	
26,040	3,000	.0057	.....	
30,380	3,500	.0068	.....	
34,720	4,000	.0078	.....	
39,060	4,500	.0089	.....	
43,400	5,000	.0100	.....	E = 2,500,000 pounds per square inch.
868	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
868	100	0.	0.	
43,400	5,000	.0012	.....	
868	100	.....	0.	
43,400	5,000	.0012	.....	
868	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{4.9}$.

Brick Contributed by The Capital City Vitrified Brick and Paving Company, Topeka, Kans.

PAVING BRICK, HARD BURNT, VERY DARK RED.

No. 1390.

Length, 7″.70.
Sectional area, 2″.30 × 3″.80 = 8.74 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
874	100	0.	0.	Initial load.
1,748	200	.0001	.....	
2,622	300	.0001	.....	
3,496	400	.0002	.....	
4,370	500	.0002	.....	
5,244	600	.0003	.....	
6,118	700	.0003	.....	
6,992	800	.0004	.....	
7,866	900	.0004	.....	
8,740	1,000	.0005	.....	
874	100	.....	.....	
13,110	1,500	.0008	0.	
17,480	2,000	.0012	.....	
21,850	2,500	.0015	.....	
26,220	3,000	.0019	.....	
30,590	3,500	.0023	.....	
34,960	4,000	.0027	.....	
39,330	4,500	.0030	.....	
43,700	5,000	.0034	.....	} E = 7,200,000 pounds per square inch.
874	100	.....	0.	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
874	100	0.	0.	Initial load.
43,700	5,000	.0003	.....	
874	100	.....	0.	
43,700	5,000	.0003	.....	
874	100	.....	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{7.9}$.

BRICKS CONTRIBUTED BY GLADDING, MCBEAN & CO., SAN FRANCISCO, CAL.

FRONT PRESSED BRICK, SEMI-DRY MACHINE, HARD BURNT, BUFF COLOR.

No. 1387.

Length, 8″.17.
Sectional area. 2″.43 × 4″.10 = 9.96 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
996	100	0.	0.	Initial load.
1,992	200	.0008	.....	
2,988	300	.0016	.....	
3,984	400	.0024	.....	
4,980	500	.0033	.....	
5,976	600	.0042	.....	
6,972	700	.0055	.....	
7,968	800	.0073	.....	
8,964	900	.0100	.....	
9,280	932	.....	.....	Ultimate strength.

FRONT PRESSED BRICK, STIFF MUD MACHINE, SOFT BURNT, CREAM COLOR.

No. 1388.

Length, 8″.40.
Sectional area, 2″.36 × 4″.22 = 9″.96.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
996	100	0.	0.	Initial load.
1,992	200	.0003	.....	
2,988	200	.0005	.....	
3,984	400	.0008	.....	
4,980	500	.0010	.....	
5,976	600	.0012	.....	
6,972	700	.0014	.....	
7,968	800	.0016	.....	
8,964	900	.0018	.....	
9,960	1,000	.0020	.....	
996	100	.....	0.	
14,940	1,500	.0030	.....	
19,920	2,000	.0040	.....	
996	100	.....	.0002	
24,900	2,500	.0050	.....	
29,880	3,000	.0059	.....	
996	100	.....	.0002	
34,860	3,500	.0070	.....	
39,840	4,000	.0081	.....	
44,820	4,500	.0092	.....	
49,800	5,000	.0102	.....	E=2,500,000 pounds per square inch.
996	100	.....	.0004	

Lateral expansion under endwise compression loads.

Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
996	100	0.	0.	Initial load.
49,800	5,000	.0012	----------	
996	100	----------	0.	
49,800	5,000	.0012	----------	
996	100	----------	0.	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{5.7}$.

FIRE BRICK, LIGHT BUFF COLOR.

No. 1389.

Length, 9″.04.
Sectional area, 2″.46 × 4″.51 = 11.09 square inches.
Gauged length, 5″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,109	100	0.	0.	Initial load.
2,218	200	.0001	----------	
3,327	300	.0003	----------	
4,436	400	.0005	----------	
5,545	500	.0007	----------	
6,654	600	.0009	----------	
7,763	700	.0012	----------	
8,872	800	.0014	----------	
9,981	900	.0016	----------	
11,090	1,000	.0018	----------	
1,109	100	----------	.0001	
16,635	1,500	.0028	----------	
22,180	2,000	.0039	----------	
1,109	100	----------	.0002	
27,725	2,500	.0051	----------	
33,270	3,000	.0065	----------	E = 2,420,000 pounds per square inch.
1,109	100	----------	.0005	

Lateral expansion under endwise compression loads.
Transverse gauged length, 3″.5.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,109	100	0.	0.	Initial load.
33,270	3,000	.0007	----------	
1,109	100	----------	0.	
33,270	3,000	.0007	----------	
1,109	100	----------	.0001	

Ratio of lateral expansion to longitudinal compression, $\frac{1}{6.5}$.

EXPANSION OF BRICKS.

TABLE SHOWING THE EFFECT OF TREATMENT OF BRICKS IN WATER AND AIR AT DIFFERENT TEMPERATURES.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
			°F.	*Inches.*	*Inch.*
Kansas City Hydraulic Press Brick Co., Kansas City, Mo.	Red brick No. 1	Open air	68	5.9967	.....
		In water bath 8 days	66½	5.9974	.....
		In cold water	33	5.9967	.....
		In hot water	212	6.0006	.00000326
		In cold water	33	5.9971	
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	5.9980	.....
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	5.9969	.....
		Removed from cold bath and frozen second time	28	5.9979	.....
Do	Red brick No. 2	Open air	68	5.9997	.....
		In water bath 8 days	66½	6.0000	.....
		In cold water	33	5.9995	.....
		In hot water	212	6.0036	.00000317
		In cold water	33	6.0002	
		Removed from cold bath and while saturated with water placed out of doors over night and frozen	25	6.0010	.....
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0000	.....
		Removed from cold bath and frozen second time	28	6.0013	.....
Powhatan Clay Manufacturing Co., Richmond, Va.	Cream white, No. 1.	Open air	68	5.9996	.....
		In water bath 8 days	66½	6.0000	.....
		In cold water	33	5.9998	.....
		In hot water	212	6.0021	.00000205
		In cold water	33	5.9999	
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	6.0024	.....
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0004	.....
		Removed from cold bath and frozen second time	28	6.0029	.....
Do	Dark red, No. 2.	Open air	68	6.0002	.....
		In water bath 8 days	66½	6.0002	.....
		In cold water	33	5.9998	.....
		In hot water	212	6.0037	.00000289
		In cold water	33	6.0006	
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	6.0015	.....
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0004	.....
		Removed from cold bath and frozen second time	28	6.0010	.....
The Hydraulic Press Brick Co., St. Louis, Mo.	Medium red ..	Open air	68	5.9997	.....
		In water bath 8 days	66½	5.9997	.....
		In cold water	33	5.9989	.....
		In hot water	212	6.0031	.00000317
		In cold water	33	5.9997	
		Removed from cold water, and while saturated with water placed out of doors over night and frozen	25	6.0014	.....
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0000	.....
		Removed from cold bath and frozen second time	28	6.0017	.....

Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
			°F.	*Inches.*	*Inch.*
The Hydraulic Press Brick Co., St. Louis, Mo.	Light chocolate.	Open air	67	6.0005	
		In water bath 8 days	66½	6.0002	
		In cold water	33	5.9995	
		In hot water	212	6.0056	.00000475
		In cold water	33	6.0005	
		Removed from cold bath and frozen in open air	26	6.0060	
		In water bath 2 months; temperature, 65° F.; then in cold water 12 hours	33	6.0029	
Do	Dark buff speckled.	Open air	67	6.0015	
		In water bath 8 days	66½	6.0020	
		In cold water	33	6.0012	
		In hot water	212	6.0060	.00000391
		In cold water	33	6.0018	
		Removed from cold bath and frozen in open air	26	6.0041	
		In water bath 2 months; temperature, 65° F.; then in cold water 12 hours	33	6.0030	
Philadelphia and Boston Face Brick Co., Boston, Mass.	Salmon colored.	Open air	68	6.0015	
		In water bath 8 days	66½	6.0017	
		In cold water	33	6.0012	
		In hot water	212	6.0058	.00000335
		In cold water	33	6.0022	
		Removed from cold bath and while saturated with water placed out of doors over night and frozen	25	6.0065	
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0032	
		Removed from cold bath and frozen second time	28	6.0088	
Do	Salmon colored.	Open air	68	5.9975	
		In water bath 8 days	66½	5.9979	
		In cold water	33	5.9974	
		In hot water	212	6.0018	.00000261
		In cold water	33	5.9990	
		Removed from cold bath and while saturated with water placed out of doors over night and frozen	25	6.0018	
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0000	
		Removed from cold bath and frozed second time	28	6.0030	
Do	Chocolate brown.	Open air	67	5.9953	
		In water bath 8 days	66½	5.9956	
		In cold water	33	5.9952	
		In hot water	212	5.9985	.00000298
		In cold water	33	5.9953	
		Removed from cold bath and frozen in open air	26	5.9978	
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours	33	5.9962	
Do	Cream color	Open air	67	5.9972	
		In water bath 8 days	66½	5.9975	
		In cold water	33	5.9967	
		In hot water	212	6.0006	.00000252
		In cold water	33	5.9979	
		Removed from cold bath and frozen in open air	26	6.0037	
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours	33	6.0004	
Do	Buff color	Open air	67	6.0041	
		In water bath 8 days	66½	6.0044	
		In cold water	33	6.0038	
		In hot water	212	6.0081	.00000298
		In cold water	33	6.6049	
		Removed from cold bath and frozen in open air	26	6.0102	
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours	33	6.0075	

Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
			°F.	*Inches.*	*Inch.*
Eastern Hydraulic Press Brick Co., Philadelphia, Pa.	Shade 200	Open air	68	5.9989	
		In water bath 8 days	66½	5.9994	
		In cold water	33	5.9985	
		In hot water	212	6.0029	.00000345
		In cold water	33	5.9992	
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0020	
		Placed in water bathat 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0003	
		Removed from cold bath and frozen second time	28	6.0029	
Do	Shade 300	Open air	68	6.0003	
		In water bath 8 days	66½	6.0007	
		In cold water	33	6.0001	
		In hot water	212	6.0046	.00000344
		In cold water	33	6.0009	
		Removed from cold bath and frozen in open air	26	6.0037	
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours	33	6.0019	
Do	Shade 410	Open air	67	6.0023	
		In water bath 8 days	66½	6.0031	
		In cold water	33	6.0017	
		In hot water	212	6.0085	.00000568
		In cold water	33	6.0024	
		Removed from cold bath and frozen in open air	26	6.0043	
Brooke Terra Cotta Co., Lazearville W. Va.	Columbian buff, No. 4.	Open air	68	6.0004	
		In water bath 8 days	66½	6.0003	
		In cold water	33	5.9991	
		In hot water	212	6.0024	.00000242
		In cold water	33	5.9998	
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0040	
		Placed in water bath at 65° F. while frozen, 6 hours, then placed in cold bath	33	6.0012	
		Removed from cold bath and frozen second time	28	6.0070	
Do	Light buff	Open air	67	5.9993	
		In water bath 8 days	66½	5.9997	
		In cold water	33	5.9995	
		In hot water	212	6.0020	.00000205
		In cold water	33	5.9998	
		Removed from cold bath and frozen in open air	26	6.0015	
		In water bath at 65° F. 2 months, then in cold bath 12 hours	33	5.9997	
Gladding McBean & Co., San Francisco, Cal.	Dark buff, hard burnt.	Open air	67	6.0026	
		In water bath 8 days	66½	6.0032	
		In cold water	33	6.0021	
		In hot water	212	6.0068	.00000419
		In cold water	33	6.0023	
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0037	
		Placed in water bath at 65° F. 6 hours while frozen, then placed in cold bath	33	6.0026	
		Removed from cold bath and frozen second time	28	6.0045	
Do	Salmon, soft burnt.	Open air	67	6.0028	
		In water bath 8 days	66½	6.0032	
		In cold water	33	6.0024	
		In hot water	212	6.0076	.00000428
		In cold water	33	6.0030	
		Removed from cold bath and frozen in open air	26	6.0092	

Treatment of bricks in water and air at different temperatures—Continued.

Contributor.	Description.	Treatment.	Temperature.	Gauged length.	Coefficient of expansion.
			°F.	*Inches.*	*Inch.*
Northern Hydraulic Press Brick Co., Minneapolis, Minn.	Red brick.....	Open air	67	6.0005	.....
		In water bath 8 days	66½	6.0008	.....
		In cold water	33	6.0002	.....
		In hot water	212	6.0040	.00000316
		In cold water	33	6.0006	
		Removed from cold bath, and while saturated with water placed out of doors over night and frozen	25	6.0012	.....
		Placed in water bath at 65°F. while frozen, 6 hours, then placed in cold bath	33	6.0005	.....
		Removed from cold bath and frozen second time	28	6.0016	.....
Chicago Hydraulic Press Brick Co., Chicago, Ill.	.....do	Open air	67	6.0007	.....
		In water bath 8 days	66½	6.0010	.....
		In cold water	33	6.0001	.....
		In hot water	212	6.0045	.00000344
		In cold water	33	6.0008	
		Removed from cold bath and frozen in open air	26	6.0042	.....
Clark Pressed Brick Co., Malvern, Ark.	Chocolate.....	Open air	67	6.0039	.....
		In water bath 8 days	66½	6.0041	.....
		In cold water	33	6.0033	.....
		In hot water	212	6.0125	.00000744
		In cold water	33	6.0045	
		In hot water	212	6.0128	.00000754
		In cold water	32	6.0047	
		In water bath 2 months, temperature 65° F., then in cold bath 12 hours	33	6.0050	.....
		Taken from cold bath and exposed out of doors over night.....	28 to 30	6.0098	.....

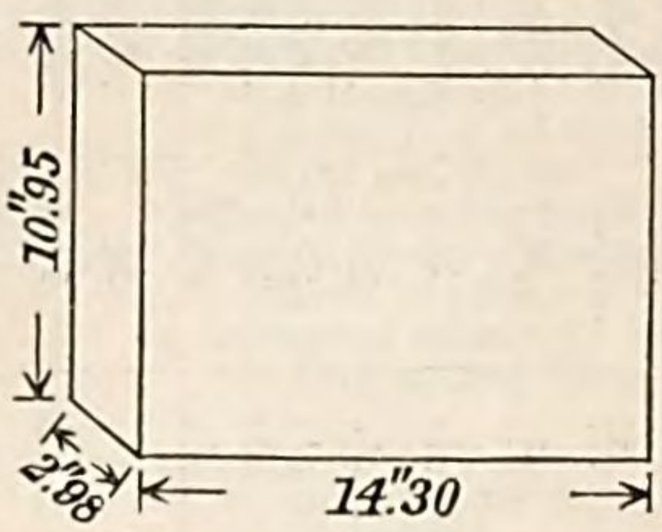
BRICKS.

TABULATION OF COMPRESSIVE MODULI OF ELASTICITY, LATERAL EXPANSION UNDER ENDWISE COMPRESSION, COEFFICIENTS OF EXPANSION, AND EXPANSION DUE TO FREEZING WHILE SATURATED WITH WATER, ALSO ABSORPTION OF WATER.

No. of test, compressive elastic properties.	Contributor.	Description.	Modulus of elasticity per square inch.	Ratio of lateral expansion to longitudinal compression.	Total absorption after exposure to boiling water, by volume.	Coefficient of expansion.	Expansion by freezing, in 6 inches.	Permanent set after freezing, in 6 inches.
			Pounds.		*Per cent.*	*Inch.*	*Inch.*	*Inch.*
1373	Kansas City Hydraulic Press Brick Co., Kansas City, Mo	Red brick No. 1	1,650,000	$\frac{1}{7.5}$	26.8	.00000326	.0009 .0008	—.0002 .....
1374	.....do	Red brick No. 2	2,130,000	$\frac{1}{6.7}$	25.1	.00000317	.0008 .0011	—.0002 .....
1378	The Powhatan Clay Manufacturing Co., Richmond, Va	Cream white No. 1	1,730,000	$\frac{1}{5.5}$	26.7	.00000205	.0025 .0030	.0005 .....
1377	.....do	Dark red No. 2	3,180,000	$\frac{1}{2.3}$	18	.00000289	.0009 .0004	—.0002 .....
1370	The Hydraulic Press Brick Co., St. Louis, Mo	Medium red	714,000	$\frac{1}{7.7}$	32	.00000317	.0017 .0020	.0003 .....
1371	.....do	Light chocolate	2,550,000	$\frac{1}{7.5}$	23.2	.00000475	.0055	.0024
1372	.....do	Dark buff speckled	890,000	$\frac{1}{4.3}$	23.7	.00000391	.0023	.0012
1381	Philadelphia and Boston Face Brick Co., Boston, Mass	Salmon color, soft burnt, for inside work.	391,000	$\frac{1}{7.3}$	36.2	.00000335	.0043 .0066	.0010 .....
1382	.....do	.....do	517,000	$\frac{1}{8.7}$	34	.00000261	.0028 .0040	.0010 .....
1386	.....do	Chocolate brown, for outside work.	5,000,000	$\frac{1}{6}$	13.6	.00000298	.0025	.0009
1384	.....do	Cream color, for outside work	577,000	$\frac{1}{5.5}$	35.3	.00000252	.0058	.0025
1385	.....do	Buff color, for outside work	2,570,000	$\frac{1}{6.3}$	24.8	.00000298	.0053	.0026
1365	Eastern Hydraulic Press Brick Co., Philadelphia, Pa	Shade 200	2,120,000	$\frac{1}{8.8}$	17.8	.00000345	.0028 .0037	.0011 .....
1366	.....do	Shade 300	2,050,000	$\frac{1}{6}$	18.7	.00000344	.0028	.0010
1367	.....do	Shade 410	2,170,000	$\frac{1}{5.6}$	17.4	.00000568	.0019	.....
1375	Brooke Terra Cotta Co., Lazearville, W. Va	Columbian buff No. 4	4,060,000	$\frac{1}{5.9}$	21.3	.00000242	.0042 .0072	.0014 .....
1376	.....do	Light buff	4,820,000	$\frac{1}{6.4}$	16.9	.00000205	.0017	—.0001
1380	Gladding, McBean & Co., San Francisco, Cal	Dark buff, hard burnt	4,450,000	$\frac{1}{4.8}$	21.2	.00000419	.0014 .0022	.0003 .....
1379	.....do	Salmon, soft burnt	1,770,000 2,290,000	$\frac{1}{2.8}$	26.3	.00000428	.0062	.....
1364	Northern Hydraulic Press Brick Co., Minneapolis, Minn	Red brick	1,040,000	$\frac{1}{4}$	29.2	.00000316	.0006 .0010	—.0001 .....
1368	Chicago Hydraulic Press Brick Co., Chicago, Ill	.....do	1,410,000	$\frac{1}{6}$	22	.00000344	.0034	.....
1363	Clark Press Brick Co., Malvern, Ark	Chocolate	1,520,000	$\frac{1}{6}$	24.1	.00000744 .00000754	..... .0048	....

No. 8368.

COMPRESSION OF BUILDING BLOCK FURNISHED BY JOHN COOK, AVON PARK, DE SOTO COUNTY, FLORIDA.



Compressed surfaces faced with plaster of Paris to secure even bearings in the testing machine.

Sectional area, $14''.30 \times 2''.98 = 42.61$ square inches.

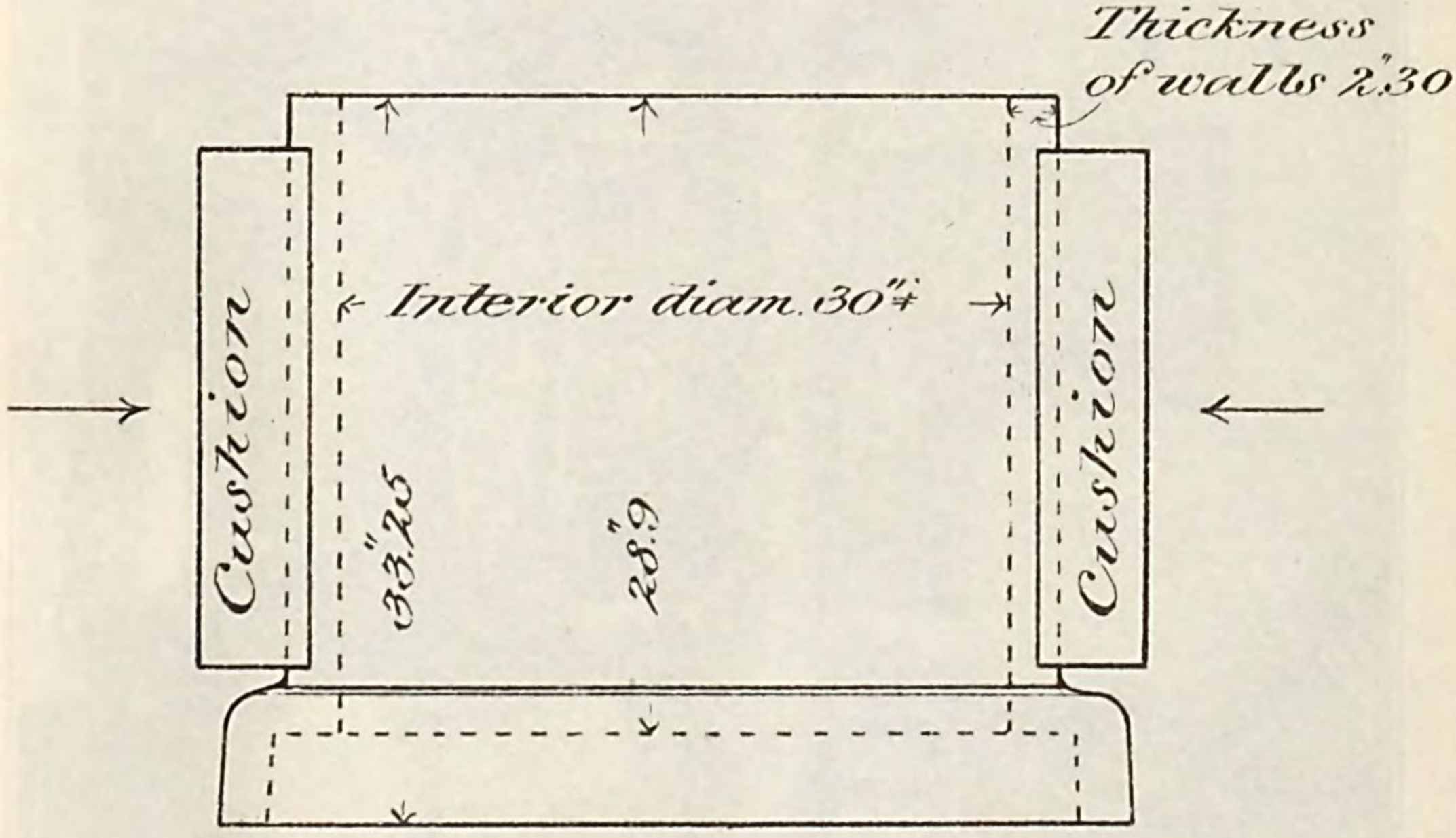
First crack at 19,980 pounds.

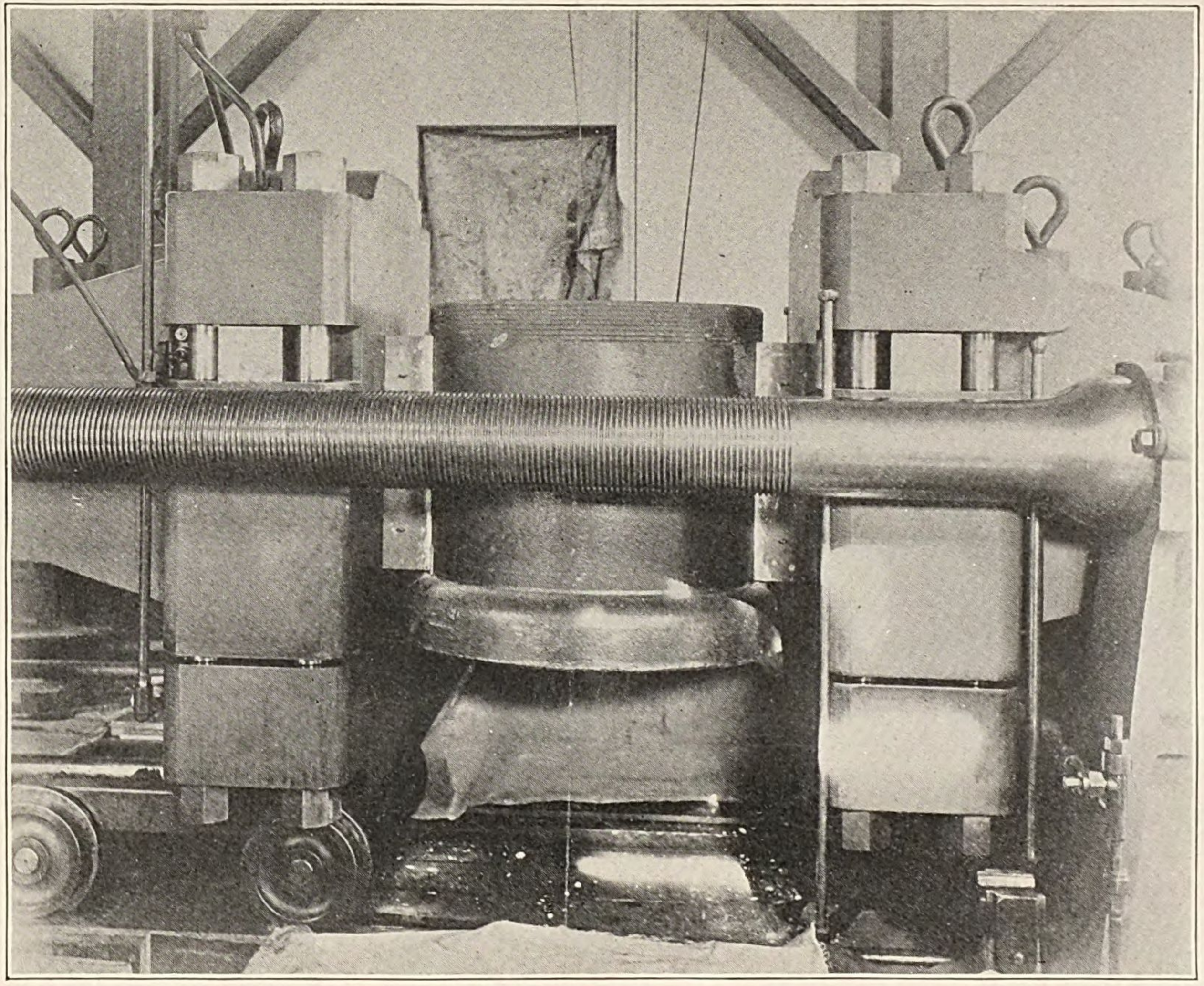
Ultimate strength 19,980 pounds=469 pounds per square inch.

COMPRESSION TESTS OF CULVERT PIPE.

MATERIAL FURNISHED BY THE PORTLAND STONE-WARE COMPANY, PORTLAND, ME.

30-inch Culvert pipe





PHOTOGRAPH SHOWING 30-INCH CULVERT PIPE IN POSITION IN THE TESTING MACHINE, AFTER THE TEST.

COMPRESSION TESTS OF CULVERT PIPE.

Tested between hard-wood cushions fitted to diameter of pipe, and covering approximately one-third the exterior diameter.

Samples branded "Portland Double Strength Culvert Pipe."

30-inch culvert pipe.

Length over all	inches	33.25
Interior diameter	do	30±
Thickness of walls	do	2.30
Weight	pounds	625

Dimensions of cushions: Length, 23″.6; width, 11½″.

Ultimate strength, 8,250 pounds.

The pipe failed by the development of longitudinal fractures, which divided the pipe into four principal fragments. Two fractures were developed at sides, or about 90° from the cushions, and two were located at the sides of the cushions.

30-inch culvert pipe.

Length over all	inches	33±
Interior diameter	do	30±
Thickness of walls	do	2.25
Weight	pounds	627

Dimensions of cushions: Length, 23″.6; width, 11½″.

Ultimate strength, 8,890 pounds.

The pipe failed by the development of fractures generally extending lengthwise the specimen.

There were 10 principal fragments.

24-inch culvert pipe.

Length over all	inches	34¼
Interior diameter	do	24
Thickness of walls	do	2.00
Weight	pounds	443

Dimensions of cushions: Length, 24″; width, 9¼″.

Ultimate strength, 7,120 pounds.

Developed four principal fractures in the plane of diameters, perpendicular and parallel to the direction of loading.

24-inch culvert pipe.

Length over all	inches	34½
Interior diameter	do	24
Thickness of walls	do	2.00
Weight	pounds	439

Dimensions of cushions: Length, 24″; width, 9¼″.

Ultimate strength, 7,310 pounds.

Manner of fracture same as first 24-inch sample.

20-inch culvert pipe.

Length over all	inches..	33½
Interior diameter	do....	20
Thickness of walls	do....	1.75
Weight	pounds..	316

Dimensions of cushions: Length, 24″; width, 7″.7.
Ultimate strength, 7,880 pounds.
Failed by developing longitudinal cracks, one of which was in a plane 90° from the direction of loading, and two were in the plane of loading diametrically opposite.

20-inch culvert pipe.

Length over all	inches..	33¾
Interior diameter	do....	20
Thickness of walls	do....	1.70
Weight	pounds..	319

Dimensions of cushions: Length, 24″; width, 7″.7.
Ultimate strength, 6,020 pounds.
Failure occurred in the same manner as the first 20-inch sample.

18-inch culvert pipe.

Length over all	inches..	39½
Interior diameter	do....	18
Thickness of walls	do....	1.62
Weight	pounds..	312

Dimensions of cushions: Length, 23½″; width, 7″.25.
Ultimate strength, 9,180 pounds.
Failed by developing longitudinal cracks in the plane of loading and at right angles thereto.
The cracks first visible were those in the plane of loading.

18-inch culvert pipe.

Length over all	inches..	39½
Interior diameter	do....	18
Thickness of walls	do....	1.61
Weight	pounds..	316

Dimensions of cushions: Length, 23½″; width, 7″.25.
Ultimate strength, 10,010 pounds.
Manner of failure similar to the first 18-inch sample.

15-inch culvert pipe.

Length over all	inches..	39½
Interior diameter	do....	15
Thickness of walls	do....	1.46
Weight	pounds..	234

Dimensions of cushions: Length, 24″; width, 5″.8.
Ultimate strength, 7,980 pounds.
Failed by developing longitudinal seams in the plane of loading and at right angles to the same.

15-inch culvert pipe.

Length over all	inches	40
Interior diameter	do	15
Weight	pounds	237

Dimensions of cushions: Length, 24″; width 5″.8.
Ultimate strength, 7,250 pounds.
Failure occurred in the same manner as the first 15-inch sample.

12-inch culvert pipe.

Length over all	inches	38¾
Interior diameter	do	12
Thickness of walls	do	1.37
Weight	pounds	181

Dimensions of cushions: Length, 24″; width, 4⅞″.
Ultimate strength, 8,160 pounds.
Developed longitudinal cracks in the plane of the applied loads, after which fractures opened on the sides at right angles to the same.

12-inch culvert pipe.

Length over all	inches	38⅝
Interior diameter	do	12
Thickness of walls	do	1.38
Weight	pounds	180

Dimensions of cushions: Length, 24″; width, 4⅞″.
Ultimate strength, 9,090 pounds.
Failed by opening longitudinal cracks.
The crack first visible was along the side at right angles to the plane of loading, which was immediately followed by a crack opening in the plane of loading.

DOUGLAS FIR WOOD

FROM THE

PACIFIC PINE LUMBER COMPANY,
SAN FRANCISCO, CAL.

DOUGLAS FIR WOOD.

The tests comprise observations on the elastic properties of the wood when loaded in different directions, also the compressive strength and tensile strength of a number of samples.

Short blocks were loaded sidewise the grain, the direction of loading with reference to the annual rings of growth being parallel, perpendicular, or oblique in different specimens.

Micrometer observations show the compressibility of the wood in these several directions.

Under the same conditions of loading, the samples from different trees showed a considerable range in compressibility, while in samples from the same tree there was a marked difference in the results when comparing the compressibility in a radial direction, with reference to the tree, with the compressibility taken in a tangential direction, the more rigid condition being found under radial loads.

As the higher loads were reached and general crushing of the fibers occurred, the advantages of radial loading became apparent in the manner of failure of the wood. There was less splitting along the grain than in the case of loads being applied tangentially to the tree. When the loading occurred oblique to the rings of growth, the failure of the sample was accompanied by splitting along the grain, similar to the effects of tangential loads.

Two gauged lengths were established on blocks from stick No. 32 for the purpose of determining both the direct compression and also the lateral expansion of the wood when loaded crosswise the grain.

Full-length sticks were strained by tension up to such total loads as the means of securing the ends by frictional grips permitted. The low crushing strength of wood crosswise the grain necessarily restricts the griping pressures to comparatively low loads, and thereby restricts the applicable tensile stress.

Both longitudinal extension and lateral contraction observations under tensile stresses were observed.

With sample No. 8544 the lateral contraction was observed on gauged lengths at three places along its length, a progressive difference being shown in the amount of contraction in passing from one end to the other of the stick. A subsequent examination of the longitudinal extension covered by two gauged lengths of 50″ each showed the stick extended more at the end displaying the greatest lateral contraction.

Sticks strained by tension were subsequently cut into shorter lengths and then tested by compression. Their elastic properties under compression loads were determined, including both longitudinal compression and lateral expansion.

Specimens were prepared to determine the full tensile strength of the wood, which were made with conical ends, the part fractured being 1″ diameter.

Stick No. 26 furnished samples straight grained, which, in one test, reached a strength of 24,137 pounds per square inch.

The other sticks tested generally sheared along the grain. The direction of the grain prevented obtaining satisfactory tensile tests, notwithstanding a second set was taken out and tested.

In the following tables are shown the tensile and compressive moduli of elasticity for loads applied in the direction of the grain and crosswise the same. In the crosswise direction the difference in effect between tangential and radial loads is shown. The ratios of lateral to direct strains are also shown by a table.

Moduli of Elasticity.

Loads applied endwise the grain.

No. of test.	No. of stick.	Modulus of elasticity per square inch.		Remarks.
		Tensile.	Compressive.	
		Pounds.	*Pounds.*	
8513	26	2,655,000 2,662,000	.....	
1449	26	.....	3,461,000	Cut from No. 8513.
8514	30	1,923,000 1,929,000	.....	
1450	30	.....	2,018,000	Cut from No. 8514.
8544	30	1,787,000 1,763,000	.....	
1451	30	.....	1,915,000	Cut from No. 8544.
8543	41	1,739,000	.....	
1452	41	.....	2,036,000	Cut from No. 8543.

Loads applied perpendicular to the grain.

No. of test.	No. of stick.	Modulus of elasticity per square inch—Direction of loading with reference to tree.		Remarks.
		Tangential.	Radial.	
		Pounds.	*Pounds.*	
1432	2	40,000	.....	
1433	2	.....	207,000	
1425	4	75,000	.....	Same specimen.
1426	4	.....	162,000	
1429	4	61,000	.....	
1430	4	.....	138,000	
1431	4	77,000	.....	
1427	6	37,000	.....	Loaded obliquely.
1428	6	.....	45,000	
1434	32	112,000	.....	
1435	32	.....	152,000	
1436	32	93,000	.....	
1437	32	.....	155,000	
1442	32	93.000	.....	
1453	32	83,580	134,300	

Ratios of lateral contraction to longitudinal extension, and lateral expansion to longitudinal compression, under tension and compression loads, respectively.

Loads applied endwise the grain.

No. of test.	No. of stick.	Tension loads.	Compression loads.	Remarks.
		Ratio.	*Ratio.*	
1449	26	----------	$\frac{1}{1.87}$	
8544	30 End A	$\frac{1}{3.56}$	----------	
	30 Middle	$\frac{1}{2.49}$	----------	
	30 End B	$\frac{1}{1.55}$	----------	
	30 End A	$\frac{1}{3.51}$	----------	Supplementary tests.
	30 End B	$\frac{1}{1.86}$	----------	Supplementary tests.
1450	30	----------	$\frac{1}{1.89}$	
1451	30	----------	$\frac{1}{1.72}$	
1452	41	----------	$\frac{1}{2.63}$	

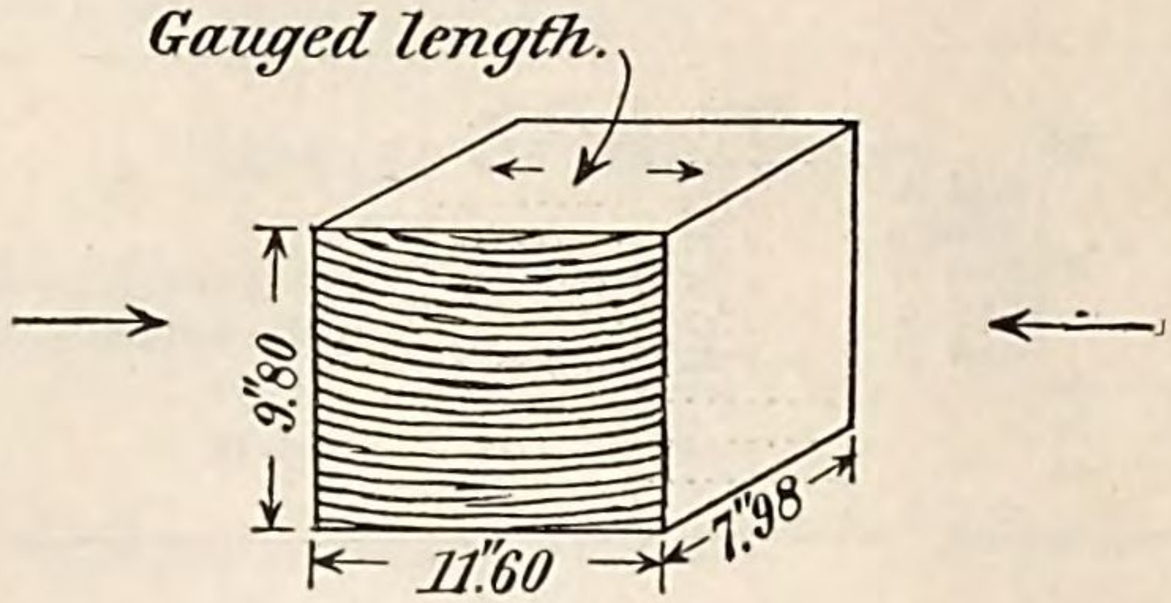
Compression loads applied crosswise the grain.

No. of test.	No. of stick.	Direction of loading with reference to tree.		Remarks.
		Tangential.	Radial.	
		Ratio.	*Ratio.*	
1453	32	$\frac{1}{2.79}$	$\frac{1}{1.61}$	
1442	32	$\frac{1}{2.86}$	----------	

Compression Tests.

No. 1432.

Sample from stick marked 2.
Loaded tangentially, or parallel to the grain.



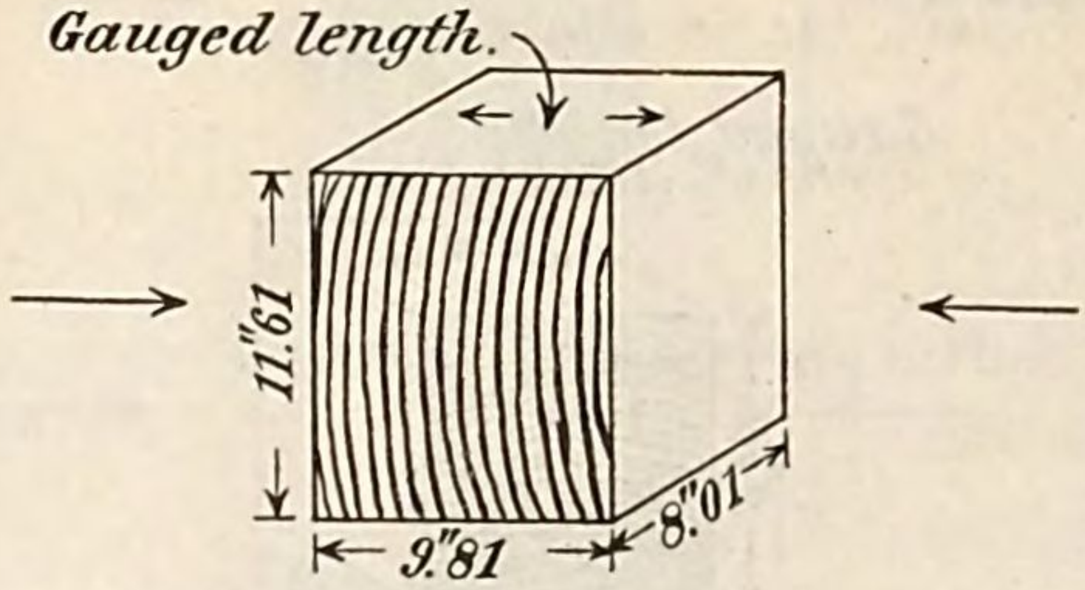
Sectional area, $9''.80 \times 7''.98 = 78.2$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,564	20	0.	0.	Initial load.
3,128	40	.0024	.....	
4,692	60	.0050	.....	
6,256	80	.0085	.....	
7,820	100	.0105	.....	
1,564	20	.....	.0017	
9,384	120	.0128	.....	
10,948	140	.0158	.....	
12,512	160	.0187	.....	
14,076	180	.0220	.....	
15,640	200	.0252	.....	
1,564	20	.....	.0042	
17,204	220	.0285	.....	
18,768	240	.0344	.....	
20,332	260	.0392	.....	
21,896	280	.0441	.....	
23,460	300	.0551	.....	} E = 40,000 pounds per square inch.
1,564	20	.....	.0132	
25,024	320	.0624	.....	
26,588	340	.0757	.....	
28,152	360	.0886	.....	
29,716	380	.1019	.....	
31,280	400	.12	.....	
32,844	420	.18	.....	
34,408	440	.35	.....	
35,972	460	.83	.....	
39,100	500	.150	.....	
47,900	613	.....	.....	Ultimate strength.

Fibers split along the grain.

No. 1433.

Sample from stick marked 2. Taken off at end of sample No. 1432. Loaded radially, or perpendicular to the rings of growth.



Sectional area, $11''.61 \times 8''.01 = 93$ square inches.
Gauged length, $6''$.

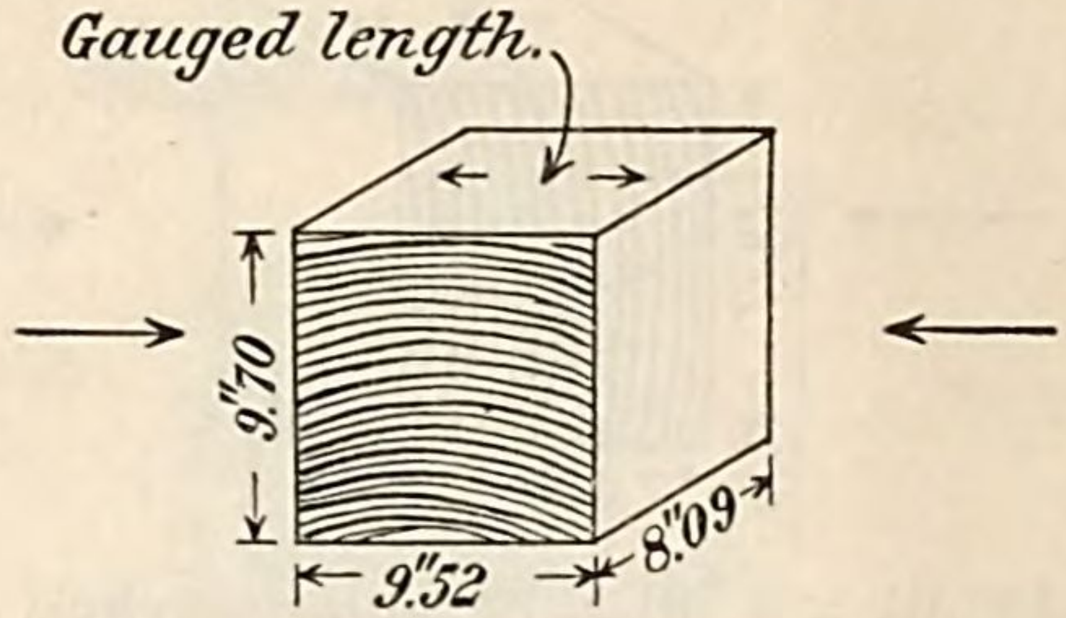
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,860	20	0.	0.	Initial load.
3,722	40	.0008	.....	
5,580	60	.0015	.....	
7,440	80	.0022	.....	
9,300	100	.0028	.....	
1,860	20	.....	.0002	
11,160	120	.0035	.....	
13,020	140	.0040	.....	
14,880	160	.0046	.....	
16,740	180	.0053	.....	
18,600	200	.0058	.....	
1,860	20	.....	.0002	
20,460	220	.0064	.....	
22,320	240	.0070	.....	
24,180	260	.0075	.....	
26,040	280	.0080	.....	
27,900	300	.0085	.....	} E = 207,000 pounds per square inch.
1,860	20	.....	.0004	
29,760	320	.0092	.....	
31,620	340	.0099	.....	
33,480	360	.0108	.....	
35,340	380	.0133	.....	
37,200	400	.0220	.....	
1,860	20	.....	.0045	
39,060	420	.0345	.....	
40,920	440	.0522	.....	
42,780	460	.09	.....	
44,640	480	.27	.....	
		.48	.....	
46,500	500	.80	.....	
55,800	600	1.10	.....	
65,100	700	1.40	.....	
74,400	800	1.58	.....	
93,000	1,000	1.93	.....	Maximum load applied. Test discontinued.

Opened along the grain at the middle of the stick, at some seasoning cracks which existed in the wood before testing.

No. 1425.

Sample cut from post marked 4.

Compressed sidewise the grain, parallel to the rings of growth, or tangentially to the tree.

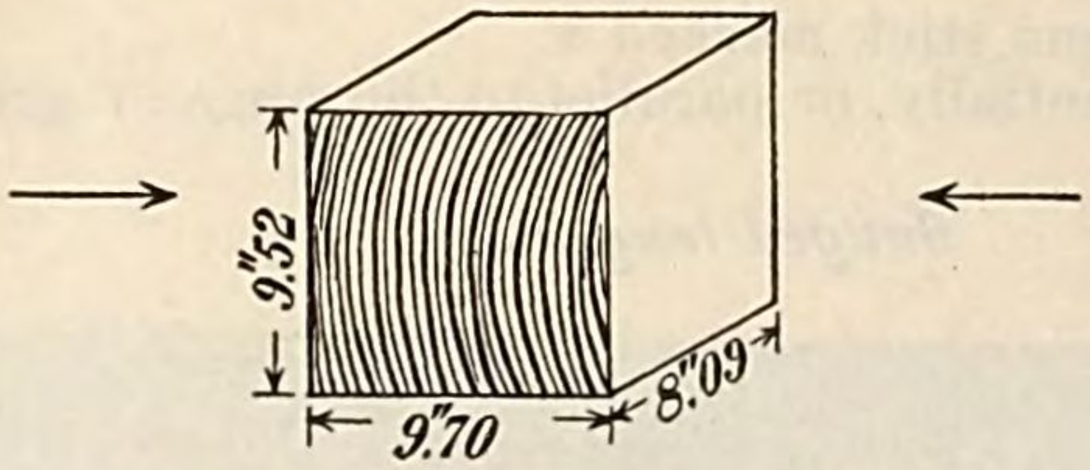


Sectional area, $9''.70 \times 8''.09 = 78.47$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,569	20	0.	0.	Initial load.
3,139	40	.0013	.....	
4,708	60	.0029	.....	
6,278	80	.0042	.....	
7,847	100	.0058	.....	
1,569	20	.....	.0003	
9,416	120	.0072	.....	
10,986	140	0088	.....	
12,556	160	0104	.....	
14,125	180	.0119	.....	
15,694	200	.0143	.....	
1,569	20	.....	.0069	
17,263	220	0157	.....	
18,833	240	0174	.....	
20,402	260	0195	.....	
21,972	280	0225	.....	
23,542	300	.0245	.....	E = 75,000 pounds per square inch.
1,569	20	.....	.0022	

Above sample turned one-quarter and loaded sidewise the grain, perpendicular to the rings of growth, or radially to the tree.

No. 1426.



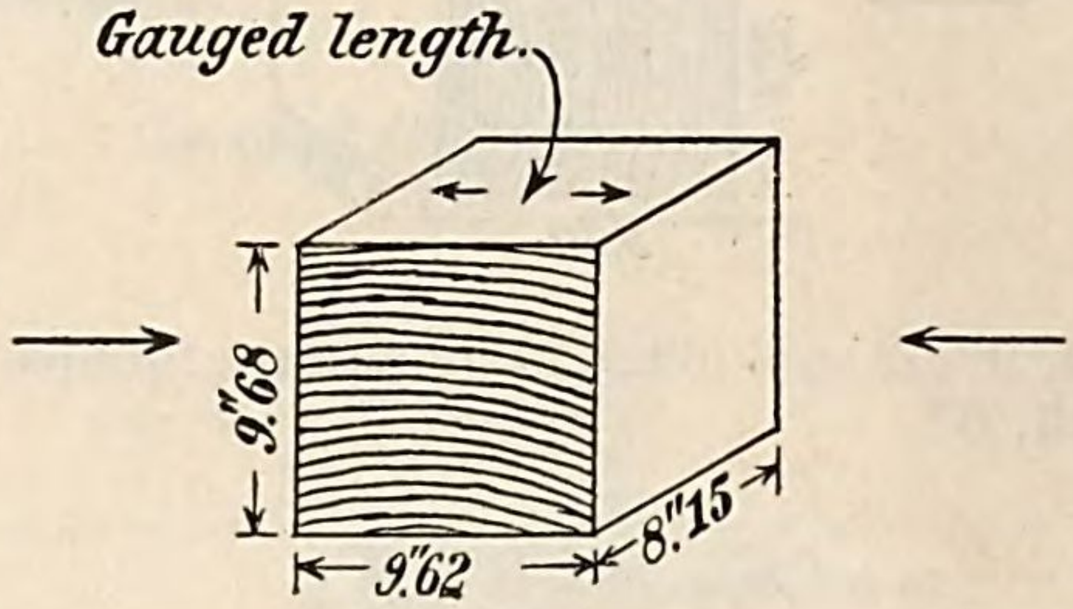
Sectional area, $9''.52 \times 8''.09 = 77.02$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,540	20	0.	0.	Initial load.
3,081	40	.0015	.....	
4,621	60	.0024	.....	
6,162	80	.0034	.....	
7,702	100	.0041	.....	
1,540	20	.....	.0007	
9,242	120	.0049	.....	
10,783	140	.0058	.....	
12,323	160	.0065	.....	
13,863	180	.0074	.....	
15,404	200	.0081	.....	
1,540	20	.....	.0014	
16,944	220	.0087	.....	
18,484	240	.0096	.....	
20,025	260	.0105	.....	
21,565	280	.0115	.....	
23,106	300	.0125	.....	E = 162,000 pounds per square inch.
1,540	20	.....	.0021	
24,646	320	.0132	.....	
26,187	340	.0144	.....	
27,727	360	.0154	.....	
29,268	380	.0166	.....	
30,808	400	.0190	.....	
1,540	20	.....	.0039	
30,808	400	.0194	.....	
32,348	420	.0211	.....	
.....	420	.0244	.....	After 3 minutes.
33,889	440	.0264	.....	
.....	440	.0289	.....	Do.
35,429	460	.0307	.....	
36,970	480	.0365	.....	
38,510	500	.0472	.....	
.....	500	.0585	.....	After 1½ minutes.
1,540	20	.....	.0211	
46,212	600	.39	.....	
53,914	700	1.21	.....	
61,616	800	1.73	.....	
69,318	900	2.07	.....	
77,020	1,000	2.25	.....	
92,424	1,200	3.40	.....	
154,040	2,000	2.74	.....	
0	0	2.32	.....	Test discontinued.

The sample was badly distorted in shape, but remained intact without fractures along the grain.

No. 1429.

Sample cut from stick marked 4.
Loaded tangentially, or parallel to the rings of growth.

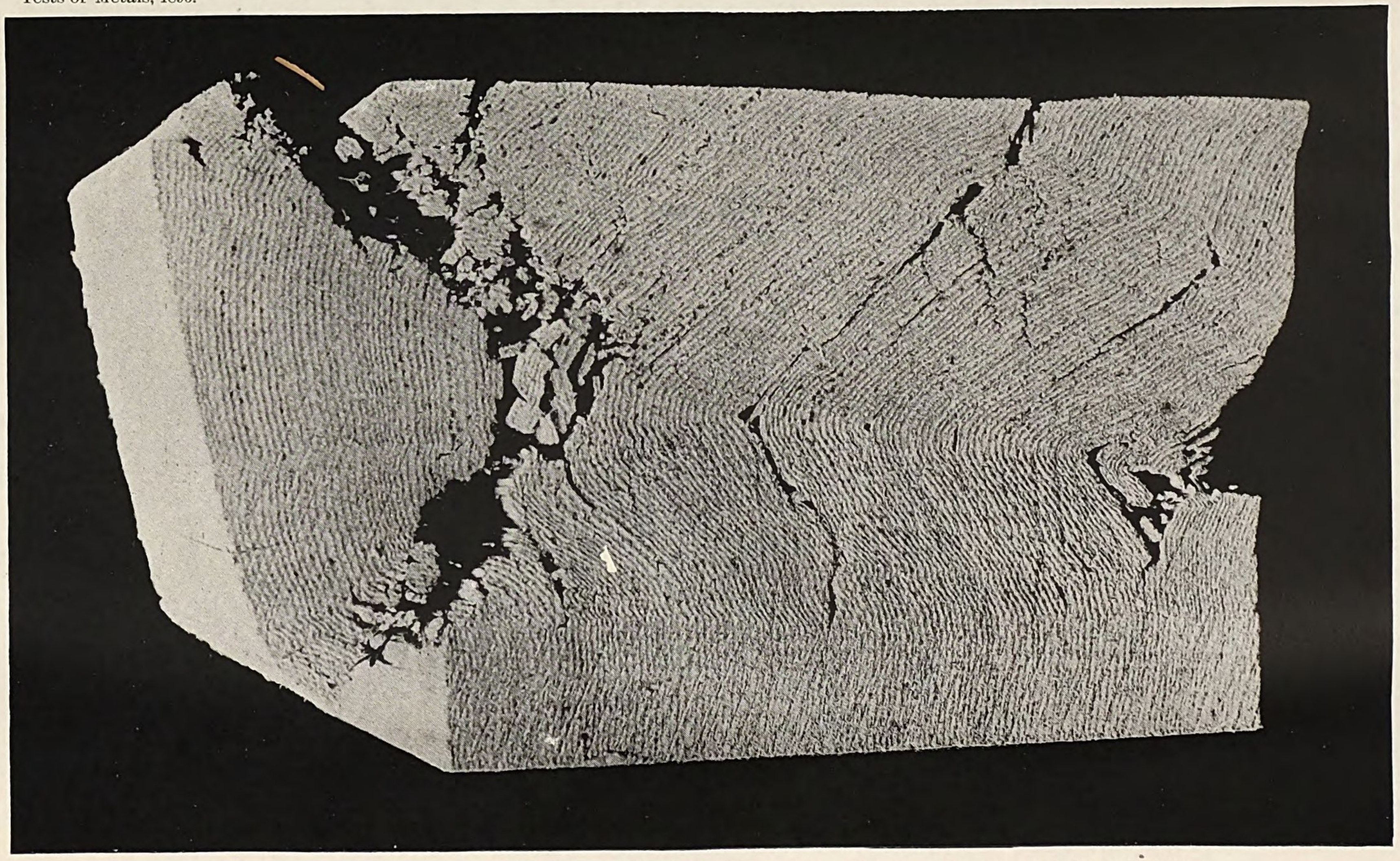


Sectional area, $9''.68 \times 8''.15 = 78.89$ square inches.
Gauged length $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,578	20	0.	0.	Initial load.
3,156	40	.0023	.....	
4,733	60	.0044	.....	
6,311	80	.0064	.....	
7,889	100	.0081	.....	
1,578	20	.....	.0011	
9,467	120	.0100	.....	
11,045	140	.0118	.....	
12,622	160	.0136	.....	
14,200	180	.0159	.....	
15,778	200	.0178	.....	
1,578	20	.....	.0021	
17,356	220	.0196	.....	
18,934	240	.0221	.....	
20,511	260	.0252	.....	
22,089	280	.0271	.....	
23,667	300	.0305	.....	
1,578	20	.....	.0052	
25,245	320	.0327	.....	
26,823	340	.0355	.....	
28,400	360	.0399	.....	
29,978	380	.0447	.....	
31,556	400	.0499	.....	} E = 61,000 pounds per square inch.
1,578	20	.....	.0125	
33,134	420	.0554	.....	
34,712	440	.0620	.....	
36,289	460	.0696	.....	
37,867	480	.0803	.....	
39,445	500	.0939	.....	
.....	500	.1074	.0400+	After 3 minutes rest.
47,334	600	.....	.....	Ultimate strength.

Failed by splitting along the grain between a wedge-shaped center and the sides of the specimen.

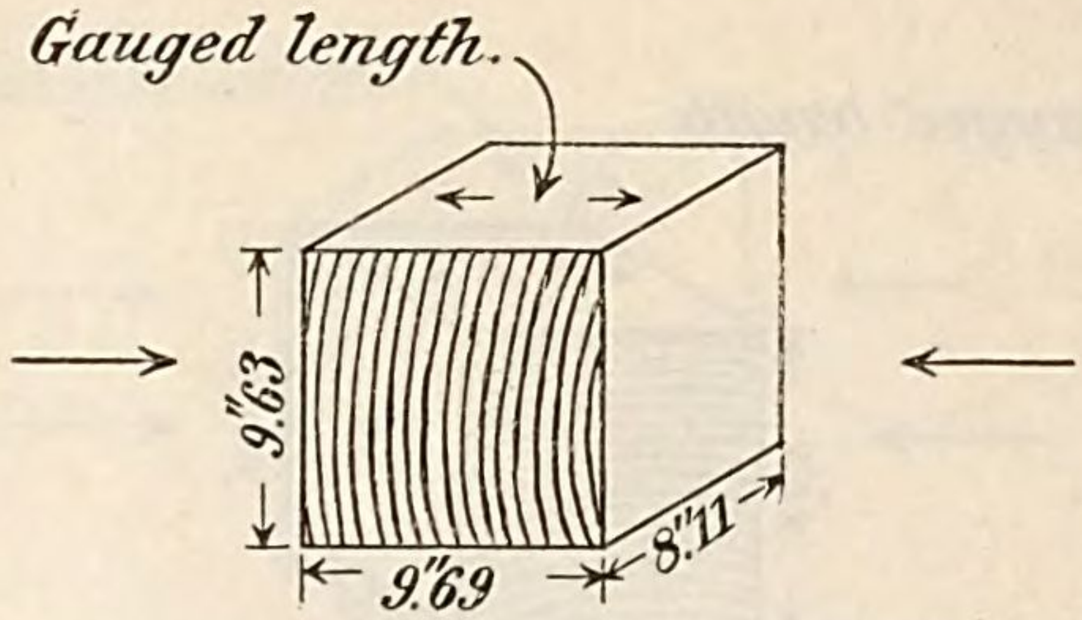
PHOTOGRAPH OF SPECIMEN NO. 1429, SHOWING EARLY STAGES OF FAILURE.



PHOTOGRAPH OF SPECIMEN NO. 1429, AFTER SUSTAINING THE MAXIMUM LOAD, 600 POUNDS PER SQUARE INCH.

No. 1430.

Sample from stick marked 4. Taken from end of No. 1429.
Loaded radially, or perpendicular to the rings of growth.



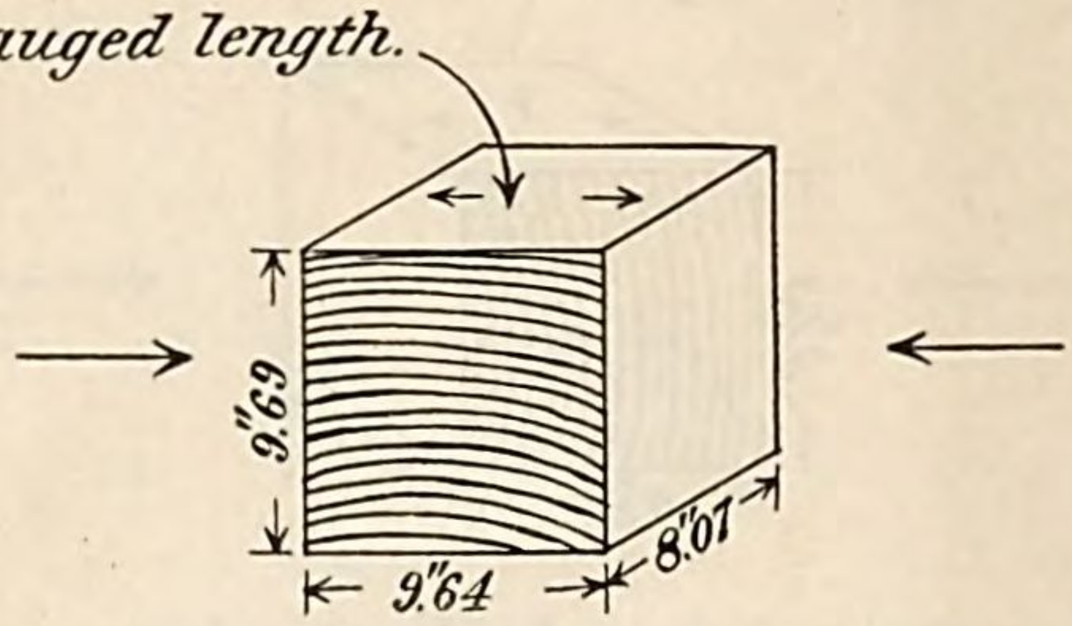
Sectional area, $9''.63 \times 8''.11 = 78.1$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,562	20	0.	0.	Initial load.
3,124	40	.0004	.....	
4,686	60	.0011	.....	
6,248	80	.0016	.....	
7,810	100	.0023	.....	
1,562	20	.....	0.	
9,372	120	.0030	.....	
10,934	140	.0037	.....	
12,496	160	.0047	.....	
14,058	180	.0054	.....	
15,620	200	.0064	.....	
1,562	20	.....	.0001	
17,182	220	.0073	.....	
18,744	240	.0083	.....	
20,306	260	.0093	.....	
21,868	280	.0103	.....	
23,430	300	.0113	.....	
1,562	20	.....	.0004	
24,992	320	.0123	.....	
26,554	340	.0133	.....	
28,116	360	.0149	.....	
29,678	380	.0162	.....	
31,240	400	.0175	.....	
1,562	20	.....	.0010	E = 138,000 pounds per square inch.
32,802	420	.0187	.....	
34,364	440	.0288	.....	
35,926	460	.0373	.....	
37,488	480	.0426	.....	
39,050	500	.0504	.....	
1,562	20	.....	.0219	
40,612	520	.0690	.....	
42,174	540	.13	.....	
43,736	560	.28	.....	
45,298	580	.42	.....	
46,860	600	.60	.....	
54,670	700	1.24	.....	
62,480	800	1.80	.....	
70,290	900	2.03	.....	
78,100	1,000	2.24	.....	
156,200	2,000	2.75	.....	
234,300	3,000	2.94	.....	Maximum load applied.

Fibers crushed laterally, but the wood did not split along the grain.

No. 1431.

Sample from stick marked 4. Taken from end of sample No. 1430.
Loaded tangentially, or parallel to the direction of the rings of growth.



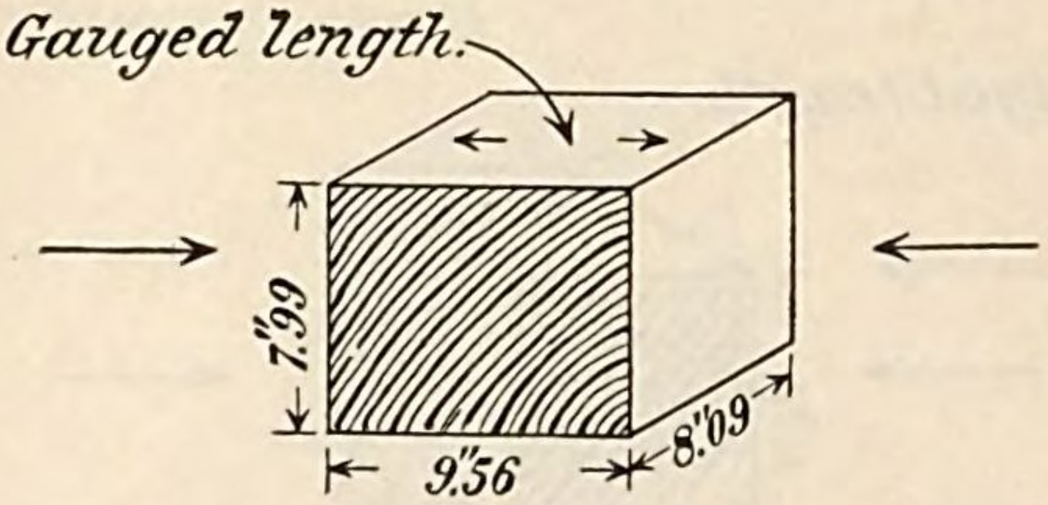
Sectional area, $9''.69 \times 8''.07 = 78.2$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,564	20	0.	0.	Initial load.
3,128	40	.0014	.....	
4,692	60	.0030	.....	
6,256	80	.0048	.....	
7,820	100	.0065	.....	
1,564	20	.....	.0008	
9,384	120	.0081	.....	
10,948	140	.0105	.....	
12,512	160	.0119	.....	
14,076	180	.0140	.....	
15,640	200	.0159	.....	
1,564	20	.....	.0019	
17,204	220	.0176	.....	
18,768	240	.0204	.....	
20,332	260	.0224	.....	
21,896	280	.0254	.....	
23,460	300	.0282	.....	
1,564	20	.....	.0052	
25,024	320	.0294	.....	
26,588	340	.0351	.....	
28,152	360	.0375	.....	
29,716	380	.0400	.....	
31,280	400	.0426	.....	} E = 77,000 pounds per square inch.
1,564	20	.....	.0129	
32,844	420	.0431	.....	Immediate compression.
.....	420	.0451	.....	After 2 minutes.
34,408	440	.0480	.....	
35,972	460	.0507	.....	
37,536	480	.06	.....	
39,100	500	.07	.....	
40,664	520	.07+	.....	
42,228	540	.08	.....	
43,792	560	.08+	.....	
45,356	580	.10	.....	
46,920	600	.12	.....	
54,740	700	.....	.....	Ultimate strength.

Fibers split along the grain. Continuing the loads the stick was reduced to a thickness of about $6''$, the load falling in the meantime to 26,000 pounds total.

No. 1427.

Sample cut from post marked 6.
Compressed sidewise the grain. Loaded obliquely to the direction of the rings of growth.



Sectional area, $8''.09 \times 7''.99 = 64.64$ square inches.
Gauged length, $6''$.

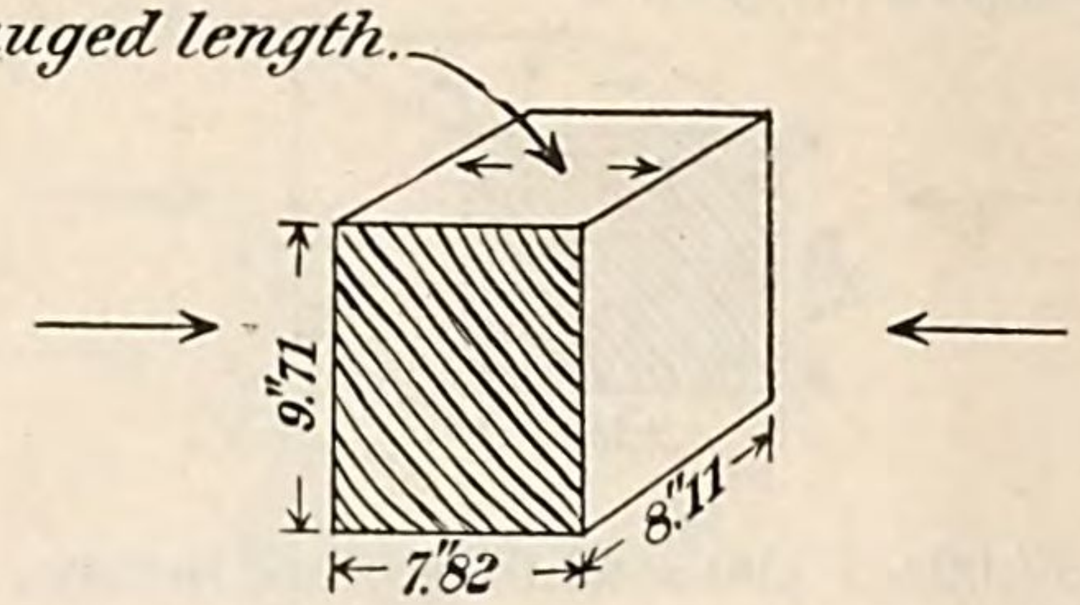
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,293	20	0.	0.	Initial load.
2,586	40	.0028	.....	
3,878	60	.0062	.....	
5,171	80	.0095	.....	
6,464	100	.0130	.....	
1,293	20	.....	.0023	
7,757	120	.0165	.....	
9,050	140	.0208	.....	
10,342	160	.0241	.....	
11,635	180	.0289	.....	
12,928	200	.0339	.....	E=37,000 pounds per square inch.
1,293	20	.....	.0050	E=37,000 pounds per square inch.
14,221	220	.0379	.....	
15,514	240	.0445	.....	
16,806	260	.0531	.....	
.....	260	.0549	.....	After 2 minutes.
1,293	20	.....	.0103	
19,392	300	.07	.....	
21,978	340	.09	.....	
24,563	380	.11	.....	
27,149	420	.14	.....	
28,400	439	.....	.....	Ultimate strength.

Failed by splitting along the rings of annual growth.

No. 1428.

Sample from post marked 6.

This sample was taken off at the end of sample No. 1427, and is tested by loads applied at right angles to the direction of loading in the previous sample.



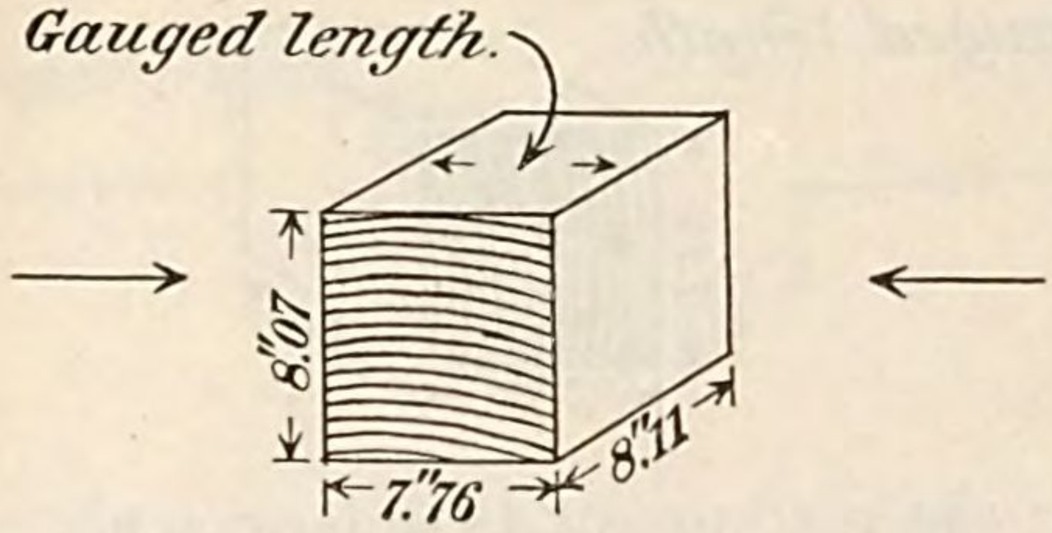
Sectional area, $9''.71 \times 8''.11 = 78.75$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,575	20	0.	0.	Initial load.
3,150	40	.0034	.....	
4,725	60	.0063	.....	
6,300	80	.0095	.....	
7,875	100	.0130	.....	
1,575	20	.....	.0030	
9,450	120	.0159	.....	
11,025	140	.0182	.....	
12,600	160	.0220	.....	
14,175	180	.0255	.....	
15,750	200	.0296	.....	E = 45,000 pounds per square inch.
1,575	20	.....	.0056	
.....	20	.....	.0054	After 30 minutes.
17,325	220	.0327	.....	
18,900	240	.0381	.....	
20,475	260	.0451	.....	
22,050	280	.0514	.....	
23,625	300	.0596	.....	
1,575	20	.....	.0125	
25,200	320	.06	.....	
26,775	340	.08	.....	
28,350	360	.10	.....	
29,925	380	.13	.....	
31,500	400	.37	.....	
33,075	420	.53	.....	
34,650	440	.70	.....	
39,375	500	1.09	.....	
78,750	1,000	2.69	.....	
0	0	2.12	.....	Test discontinued.

The sample was badly distorted but not fractured, excepting a split along the grain at one edge.

No. 1434.

Sample from stick marked 32.
Load applied tangentially, or parallel to the rings of growth.



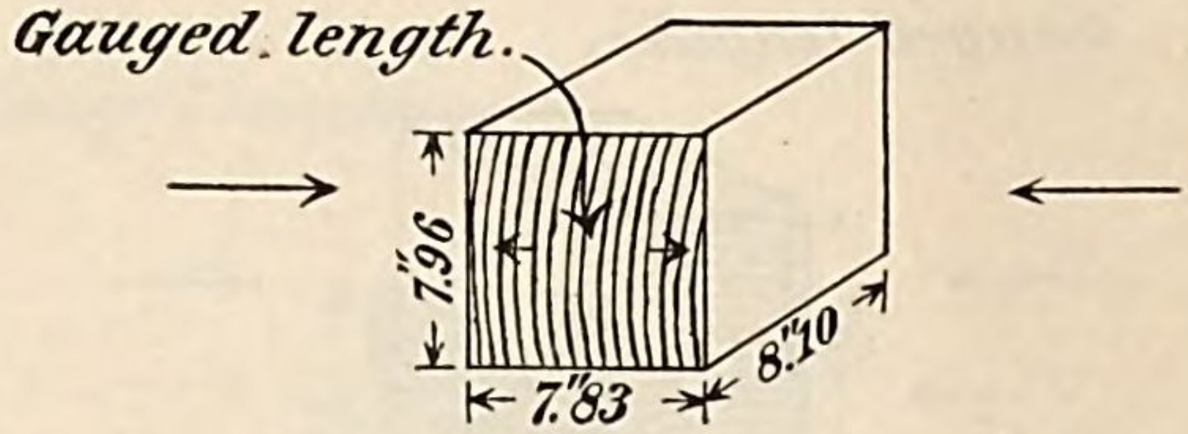
Sectional area, $8''.07 \times 8''.11 = 65.45$ square inches.
Rate of growth, 12 rings per inch.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,309	20	0.	0.	Initial load.
2,618	40	.0010	.....	
3,927	60	.0022	.....	
5,236	80	.0032	.....	
6,545	100	.0043	.....	
1,309	20	.....	.0001	
7,854	120	.0054	.....	
9,163	140	.0067	.....	
10,472	160	.0078	.....	
11,781	180	.0088	.....	
13,090	200	.0100	.....	
1,309	20	.....	.0005	
14,399	220	.0110	.....	
15,708	240	.0124	.....	
17,017	260	.0135	.....	
18,326	280	.0146	.....	
19,635	300	.0157	.....	
1,309	20	.....	.0014	
20,944	320	.0167	.....	
22,253	340	.0181	.....	
23,562	360	.0198	.....	
24,871	380	.0211	.....	
26,180	400	.0226	.....	
1,309	20	.....	.0027	
27,489	420	.0236	.....	
28,798	440	.0250	.....	
30,107	460	.0270	.....	
31,416	480	.0286	.....	
32,725	500	.0307	.....	E = 112,000 pounds per square inch.
1,309	20	.....	.0051	
34,034	520	.0326	.....	
35,343	540	.0348	.....	
36,652	560	.0365	.....	
37,961	580	.0387	.....	
39,270	600	.0404	.....	
1,309	20	.....	.0090	
40,579	620	.0416	.....	
41,888	640	.0433	.....	
43,197	660	.0444	.....	Rapid yielding occurred after passing this load.
52,360	800	.....	.....	Ultimate strength.

Failed rapidly under the maximum load, splitting along the grain.

No. 1435.

Sample from stick marked 32. Cut from stick at end of No. 1434. Loads applied radially, or perpendicular to the rings of growth.



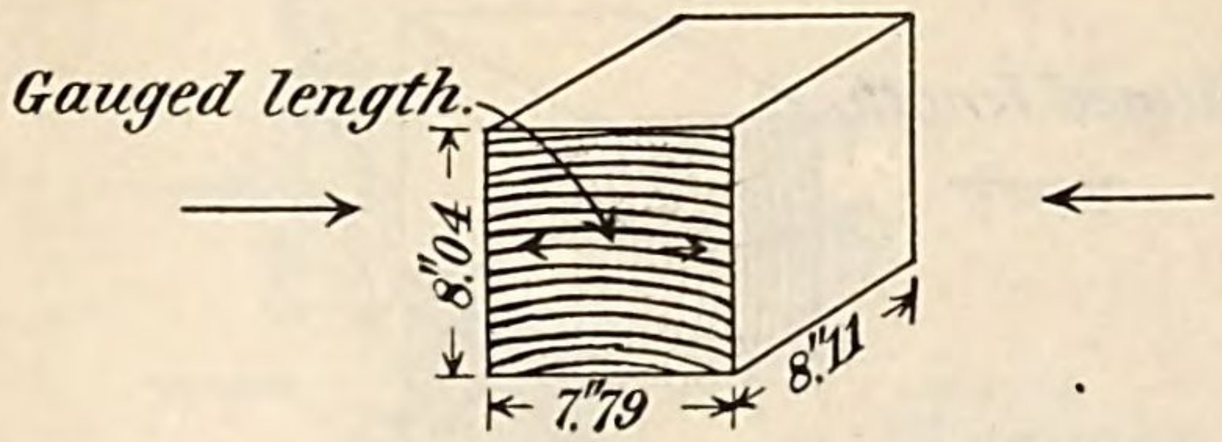
Sectional area, $7''.96 \times 8''.10 = 64.48$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,289	20	0.	0.	Initial load.
2,579	40	—.0004	.....	
3,869	60	—.0003	.....	
5,158	80	.0000	.....	
6,448	100	.0004	.....	
1,289	20	.....	—.0004	
7,738	120	.0006	.....	
9,027	140	.0011	.....	
10,317	160	.0019	.....	
11,606	180	.0026	.....	
12,896	200	.0034	.....	
1,289	20	.....	—.0005	
14,187	220	.0041	.....	
15,475	240	.0051	.....	
16,765	260	.0059	.....	
18,054	280	.0067	.....	
19,344	300	.0075	.....	
1,289	20	.....	—.0005	
20,634	320	.0084	.....	
21,923	340	.0094	.....	
23,213	360	.0102	.....	
24,502	380	.0111	.....	
25,792	400	.0120	.....	
1,289	20	.....	—.0006	
27,082	420	.0130	.....	
28,371	440	.0140	.....	
29,661	460	.0150	.....	
30,950	480	.0163	.....	
32,240	500	.0188	.....	E = 152,000 pounds per square inch.
1,289	20	.....	.0001	E = 152,000 pounds per square inch.
33,530	520	.0195	.....	
34,819	540	.0204	.....	
36,109	560	.0222	.....	
37,398	580	.0575	.....	
38,688	600	.20	.....	
39,978	620	1.30	.....	Maximum load applied.
		1.75	.....	Test discontinued.

The stick split along the grain at cracks near the middle of the specimen.

No. 1436.

Sample from stick marked 32. Cut off stick at end of sample No. 1435.
Loaded tangentially, or parallel to the rings of growth.

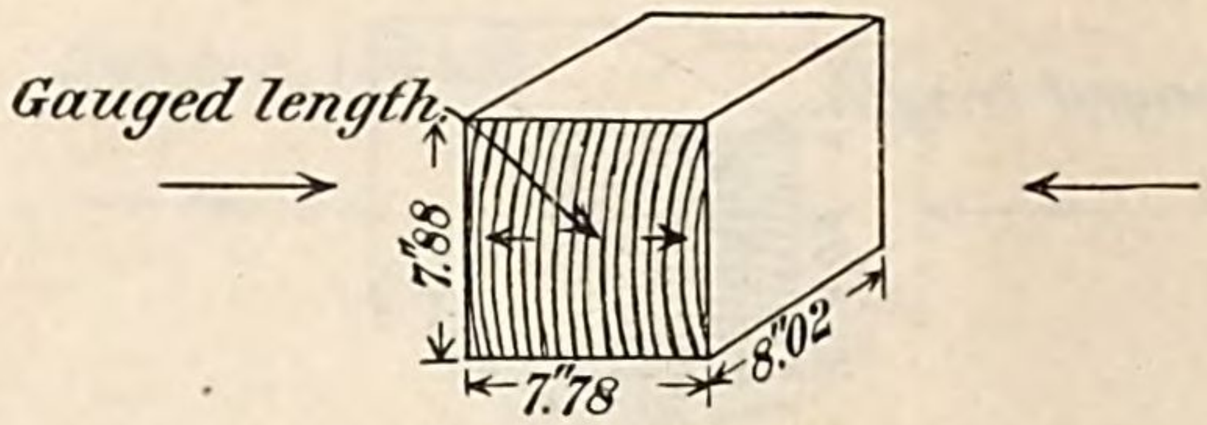


Sectional area, $8''.04 \times 8''.11 = 65.2$ square inches.
Gauged length, $6''$.

Applied loads		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,304	20	0.	0.	Initial load.
2,608	40	.0005	.....	
3,912	60	.0012	.....	
5,216	80	.0021	.....	
6,520	100	.0032	.....	
1,304	20	.....	.0000	
7,824	120	.0044	.....	
9,128	140	.0056	.....	
10,432	160	.0067	.....	
11,736	180	.0080	.....	
13,040	200	.0095	.....	
1,304	20	.....	.0003	
14,344	220	.0106	.....	
15,648	240	.0121	.....	
16,952	260	.0135	.....	
18,256	280	.0150	.....	
19,560	300	.0165	.....	
1,304	20	.....	.0012	
20,864	320	.0177	.....	
22,168	340	.0196	.....	
23,472	360	.0216	.....	
24,776	380	.0232	.....	
26,080	400	.0254	.....	
1,304	20	.....	.0030	
27,384	420	.0272	.....	
28,688	440	.0296	.....	
29,992	460	.0318	.....	
31,296	480	.0346	.....	
32,600	500	.0376	.....	} E = 93,000 pounds per square inch.
1,304	20	.....	.0068	
33,904	520	.0396	.....	
35,208	540	.0431	.....	
36,512	560	.0476	.....	
37,816	580	.0537	.....	
39,120	600	.0601	.....	
40,424	620	.0656	.....	
41,728	640	.0726	.....	
43,032	660	.0950	.....	
		.11	.....	
44,336	680	.63	.....	
45,640	700	1.01	.....	Maximum load applied. Test discontinued.

No. 1437.

Sample from stick marked 32. Cut off stick at end of No. 1436.
Loads applied radially, or perpendicular to the rings of growth.

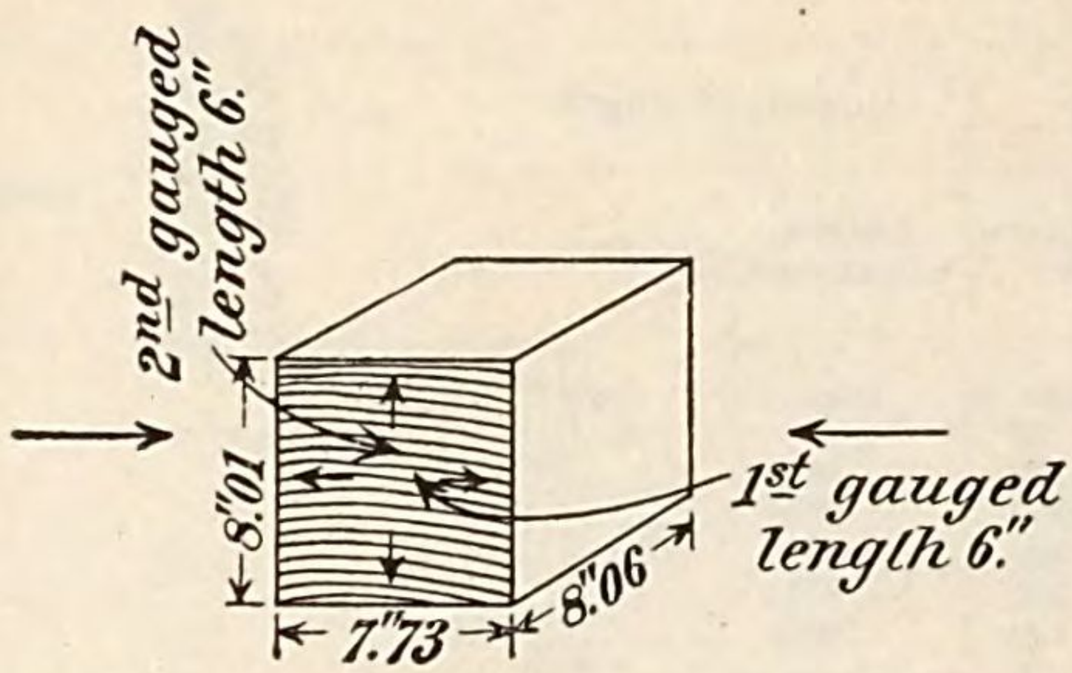


Sectional area, $7''.88 \times 8''.02 = 63.2$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,264	20	0.	0.	Initial load.
2,528	40	.0002	.....	
3,792	60	.0004	.....	
5,056	80	.0007	.....	
6,320	100	.0011	.....	
1,264	20	.....	.0000	
7,584	120	.0016	.....	
8,848	140	.0021	.....	
10,112	160	.0026	.....	
11,376	180	.0034	.....	
12,640	200	.0041	.....	
1,264	20	.....	.0003	
13,904	220	.0049	.....	
15,168	240	.0058	.....	
16,432	260	.0065	.....	
17,696	280	.0073	.....	
18,960	300	.0081	.....	
1,264	20	.....	.0003	
20,224	320	.0089	.....	
21,488	340	.0098	.....	
22,752	360	.0106	.....	
24,016	380	.0115	.....	
25,280	400	.0125	.....	
1,264	20	.....	.0006	
26,544	420	.0133	.....	
27,808	440	.0145	.....	
29,072	460	.0167	.....	
30,336	480	.0180	.....	
31,600	500	.0206	.....	} E = 155,000 pounds per square inch.
1,264	20	.....	.0020	
32,864	520	.0222	.....	
34,128	540	.0229	.....	
35,392	560	.0246	.....	
36,656	580	.08	.....	
37,920	600	.19	.....	
39,184	620	.50	.....	
40,448	640	.90	.....	
41,712	660	1.14	.....	
42,976	680	1.45	.....	
44,240	700	1.69	.....	
63,200	1,000	2.51	.....	
126,400	2,000	3.03	.....	
189,600	3,000	3.33	.....	
252,800	4,000	3.58	.....	
316,000	5,000	3.78	.....	Maximum load applied.
.....	0	3.25	.....	Immediate set.
.....	0	3.04	.....	Set after 10 minutes. Test discontinued.
.....	0	2.91	.....	Set after 2 days' rest.

No. 1442.

Sample cut from stick No. 32.
Loaded tangentially, or parallel to the rings of growth.



Sectional area, $8''.01 \times 8''.06 = 64.56$ square inches.
Observations made on the first gauged length, in the direction of the applied loads.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,291	20	0.	0.	Initial load.
2,582	40	.0005	.....	
3,874	60	.0015	.....	
5,165	80	.0026	.....	
6,456	100	.0038	.....	
1,291	20	.....	—.0001	
7,747	120	.0051	.....	
9,038	140	.0065	.....	
10,330	160	.0080	.....	
11,621	180	.0094	.....	
12,912	200	.0110	.....	
1,291	20	.....	.0003	
14,203	220	.0124	.....	
15,494	240	.0142	.....	
16,786	260	.0160	.....	
18,077	280	.0176	.....	
19,368	300	.0195	.....	} E = 93,000 pounds per square inch.
1,291	20	.....	.0014	
6,456	100	.0053	.....	
12,912	200	.0122	.....	
19,368	300	.0196	.....	
12,912	200	.0131	.....	
6,456	100	.0064	.....	
1,291	20	.....	.0016	

Lateral expansion in the direction perpendicular to the rings of growth. Observations made on the second gauged length of 6″.

Loads applied as before, tangentially, or parallel to the rings of growth.

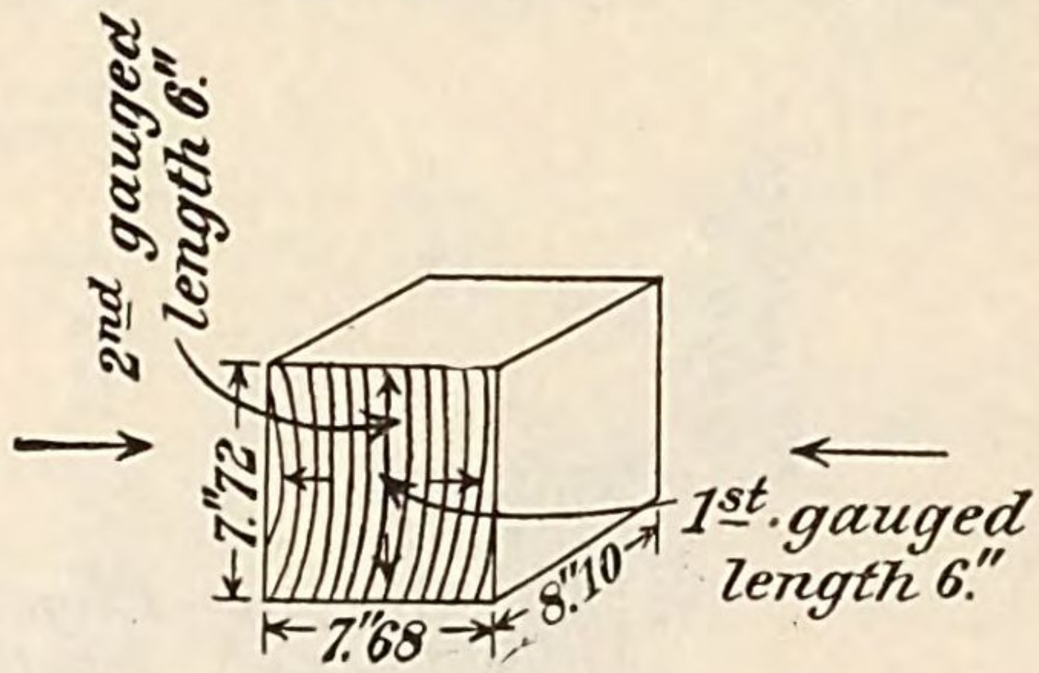
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1, 291	20	0.	0.	Initial load.
6, 456	100	.0016	.....	
12, 912	200	.0039	.....	
19, 368	300	.0064	.....	
12, 912	200	.0043	.....	
6, 456	100	.0020	.....	
1, 291	20	.....	.0001	
6, 456	100	.0018	.....	
12, 912	200	.0041	.....	
19, 368	300	.0065	.....	
12, 912	200	.0044	.....	
6. 456	100	.0020	.....	
1, 291	20	.....	.0001	

Observations on the first gauged length repeated.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1, 291	20	0.	0.	
6, 456	100	.0043	.....	
12, 912	200	.0113	.....	
19, 368	300	.0192	.....	
12, 912	200	.0124	.....	
6, 456	100	.0055	.....	
1, 291	20	.....	.0007	

No. 1453.

Sample cut from stick marked 32.
Loaded radially, or perpendicular to the rings of growth.



Sectional area, $7''.72 \times 8''.10 = 62.5$ square inches.
Observations on the first gauged length, in the direction of the applied loads.

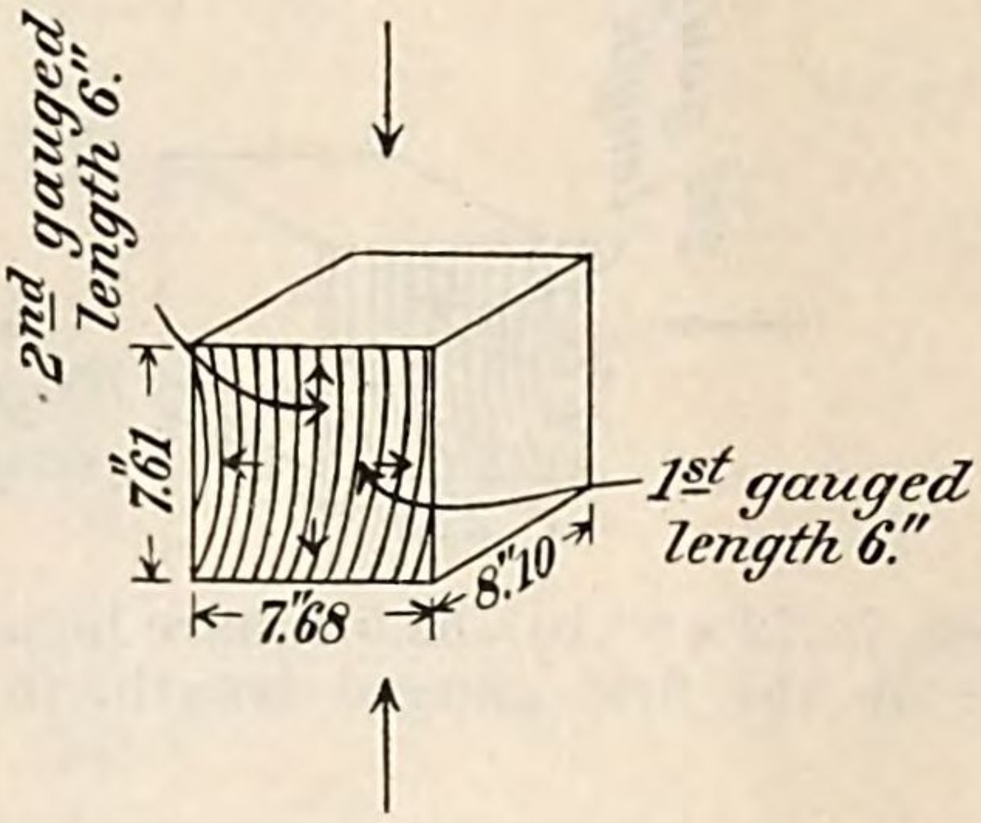
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,250	20	0.	0.	Initial load.
2,500	40	.0010	.....	
3,750	60	.0018	.....	
5,000	80	.0027	.....	
6,250	100	.0036	.....	
1,250	20	.....	.0000	
7,500	120	.0045	.....	
8,750	140	.0054	.....	
10,000	160	.0064	.....	
11,250	180	.0073	.....	
12,500	200	.0082	.....	
1,250	20	.....	.0000	
13,750	220	.0090	.....	
15,000	240	.0100	.....	
16,250	260	.0108	.....	
17,500	280	.0118	.....	
18,750	300	.0127	.....	E=134,300 pounds per square inch.
1,250	20	.....	.0001	
6,250	100	.0037	.....	
12,500	200	.0082	.....	
18,750	300	.0126	.....	
1,250	20	.....	.0001	

Lateral expansion determinations on the second gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,250	20	0.	0.	Initial load.
6,250	100	.0025	.....	
12,500	200	.0053	.....	
18,750	300	.0079	.....	Ratio of lateral expansion to longitudinal compression, $\frac{1}{1.61}$.
1,250	20	.....	.0001	
6,250	100	.0027	.....	
12,500	200	.0054	.....	
18,750	300	.0080	.....	
12,500	200	.0056	.....	
6,250	100	.0029	.....	
1,250	20	.....	.0002	

No. 1453 a.

Specimen No. 1453 dressed on two other sides and again adjusted in the machine. Now loaded tangentially, or parallel to the rings of growth.



Sectional area, 7″.68 × 8.10 = 62.2 square inches.
Observations on the second gauged length.

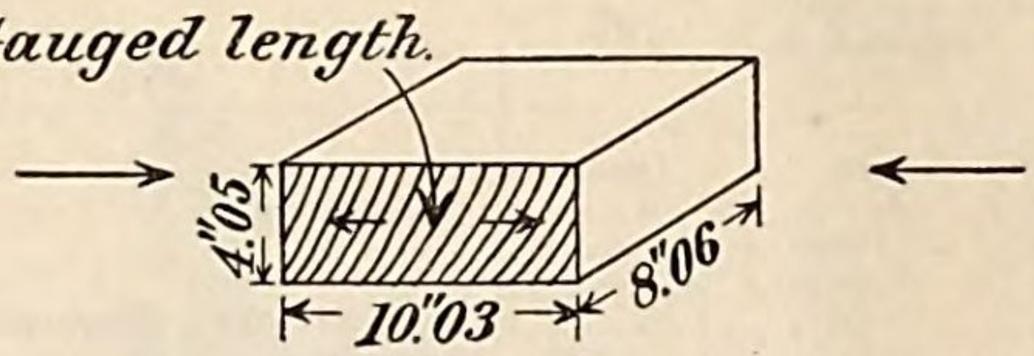
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,244	20	0.	0.	Initial load.
2,488	40	.0019	.....	
3,732	60	.0035	.....	
4,976	80	.0050	.....	
6,220	100	.0064	.....	
1,244	20	.....	0.	
7,464	120	.0078	.....	
8,708	140	.0093	.....	
9,952	160	.0108	.....	
11,196	180	.0121	.....	
12,440	200	.0136	.....	
1,244	20	.....	.0006	
13,684	220	.0150	.....	
14,928	240	.0168	.....	
16,172	260	.0183	.....	
17,416	280	.0201	.....	
18,660	300	.0218	.....	} E = 83,580 pounds per square inch.
1,244	20	.....	.0017	
6,220	100	.0077	.....	
12,440	200	.0147	.....	
18,660	300	.0221	.....	
12,440	200	.0155	.....	
6,220	100	.0085	.....	
1,244	20	.....	.0019	

Lateral expansion determinations on the first gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,244	20	0.	0.	Initial load.
6,220	100	.0023	.....	
12,440	200	.0048	.....	
18,660	300	.0073	.....	Ratio of lateral expansion to longitudinal compression, $\frac{1}{2.79}$.
1,244	20	.....	.0001	
6,220	100	.0024	.....	
12,440	200	.0050	.....	
18,660	300	.0074	.....	
12,440	200	.0050	.....	
6,220	100	.0025	.....	
1,244	20	.....	.0001	

No. 1438.

Sample cut from stick No. 33.
Loaded radially, or perpendicular to the rings of growth.

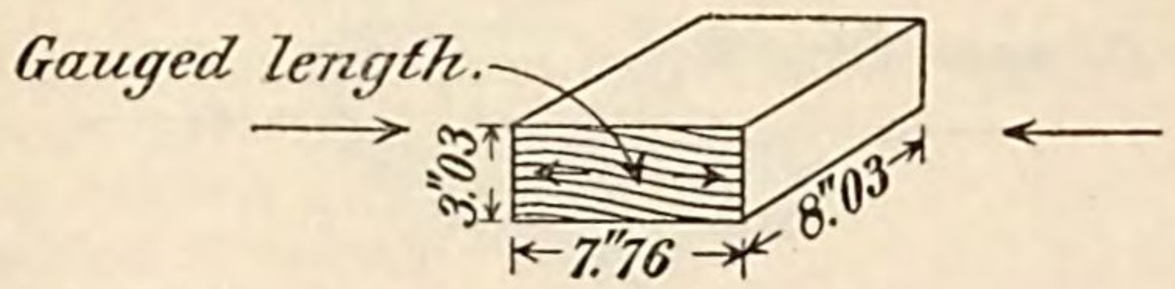


Sectional area, $4''.05 \times 8''.06 = 32.64$ square inches.
Rate of growth, 11 rings per inch.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
653	20	0.	0.	Initial load.
1,306	40	.0006	.....	
1,958	60	.0014	.....	
2,611	80	.0025	.....	
3,264	100	.0036	.....	
653	20	.....	.0001	
3,917	120	.0045	.....	
4,570	140	.0059	.....	
5,222	160	.0070	.....	
5,875	180	.0082	.....	
6,528	200	.0095	.....	
653	20	.....	.0002	
7,181	220	.0105	.....	
7,834	240	.0118	.....	
8,486	260	.0135	.....	
9,139	280	.0146	.....	
9,792	300	.0162	.....	
653	20	.....	.0008	
10,445	320	.0171	.....	
11,098	340	.0188	.....	
11,750	360	.0205	.....	
12,403	380	.0222	.....	
13,056	400	.0240	.....	E= 102,000 pounds per square inch.
653	20	.....	.0016	
13,709	420	.0251	.....	
14,362	440	.0271	.....	
15,014	460	.0294	.....	
15,667	480	.0327	.....	
16,320	500	.0351	.....	
653	20	.....	.0037	
16,973	520	.0401	.....	
17,626	540	.0447	.....	
18,278	560	.08	.....	
18,931	580	.20	.....	
19,584	600	.29	.....	
22,848	700	1.11	.....	Maximum load applied. Test discontinued.

No. 1439.

Sample cut from a stick 7″ × 8″ by 18 feet long.
Loads applied tangentially, or parallel to the rings of growth.

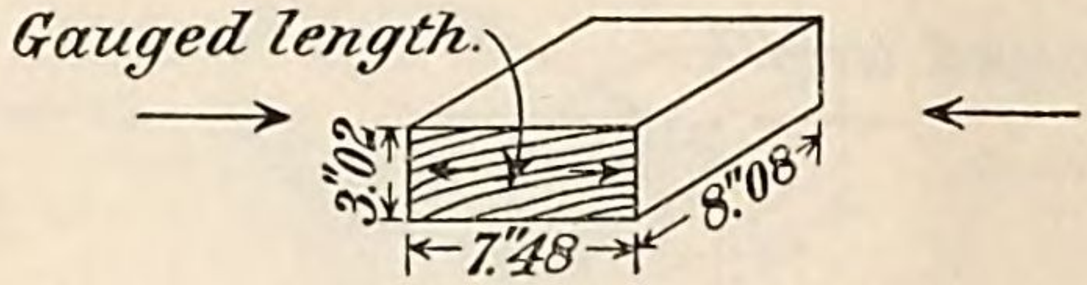


Sectional area, 3″.03 × 8″.03 = 24.33 square inches.
Rate of growth, 25 rings per inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
486	20	0.	0.	Initial load.
973	40	.0009	.....	
1,460	60	.0018	.....	
1,946	80	.0031	.....	
2,433	100	.0049	.....	
486	20	.....	0.	
2,920	120	.0068	.....	
3,406	140	.0088	.....	
3,893	160	.0104	.....	
4,379	180	.0126	.....	
4,866	200	.0143	.....	
486	20	.....	.0006	
5,353	220	.0161	.....	
5,839	240	.0185	.....	
6,326	260	.0208	.....	
6,812	280	.0233	.....	
7,299	300	.0260	.....	
486	20	.....	.0021	
7,786	320	.0289	.....	
8,272	340	.0320	.....	
8,759	360	.0354	.....	
9,245	380	.0388	.....	
9,732	400	.0425	.....	} E = 61,000 pounds per square inch.
486	20	.....	.0054	
4,866	200	.0198	.....	Load left on specimen 40 hours.
486	20	.....	.0054	Micrometer reset to last reading.
9,732	400	.0390	.....	
	400	.0434	.....	After 3 minutes.
	400	.0451	.....	After 5 minutes.
10,219	420	.0480	.....	
10,705	440	.0511	.....	
11,192	460	.0570	.....	
12,165	500	.07	.....	
14,598	600	.26	.....	Maximum load applied. Test discontinued. Fibers crushed.

No. 1440.

Sample cut from same stick and at end of No. 1439.
Loads applied tangentially, or parallel to the rings of growth.



Sectional area, $3''.2 \times 8''.08 = 24.4$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
488	20	0.	0.	Initial load.
976	40	.0013	.....	
1,464	60	.0029	.....	
1,952	80	.0043	.....	
2,440	100	.0063	.....	
488	20	.....	—.0004	
2,928	120	.0081	.....	
3,416	140	.0098	.....	
3,904	160	.0115	.....	
4,392	180	.0137	.....	
4,880	200	.0152	.....	
488	20	.....	+.0002	
5,368	220	.0174	.....	
5,856	240	.0192	.....	
6,344	260	.0214	.....	
6,832	280	.0238	.....	
7,320	300	.0263	.....	
488	20	.....	.0013	
7,808	320	.0288	.....	
8,296	340	.0318	.....	
8,784	360	.0359	.....	
9,272	380	.0396	.....	
9,760	400	.0449	.....	E = 58,000 pounds per square inch.
488	20	.....	.0059	
10,248	420	.0527	.....	
10,736	440	.0582	.....	
11,712	480	.07	.....	
12,200	500	.14	.....	
14,640	600	.58	.....	Maximum load applied. Test discontinued. Fibers crushed.

TENSION TESTS.

No. 8513.

Stick No. 26.
Dimensions, 8″.12×3″.02 by 24′ 2⅝″ long.
Weight, 163 pounds=39.6 pounds per cubic foot.
Average rate of growth, 15 rings per inch.
Ends held by friction grip holders.
Counterweighted at middle.
Distance between jaws of machine, 245″.
Sectional area, 24.5 square inches.
Gauged length, 200″.

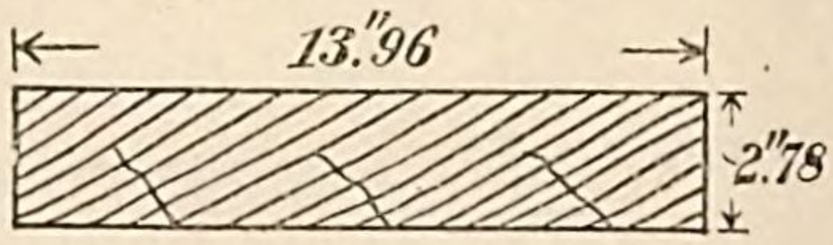
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,450	100	0.	0.	Initial load.
4,900	200	.0076	.....	
7,350	300	.0156	.....	
9,800	400	.0234	.....	
12,250	500	.0309	.....	
2,450	100	.....	.0005	
14,700	600	.0386	.....	
17,150	700	.0464	.....	
19,600	800	.0539	.....	
22,050	900	.0616	.....	
24,500	1,000	.0690	.....	
2,450	100	.....	.0009	
26,950	1,100	.0761	.....	
29,400	1,200	.0833	.....	
31,850	1,300	.0911	.....	
34,300	1,400	.0985	.....	
36,750	1,500	.1066	.....	
24,500	1,000	.0699	.....	
12,250	500	.0319	.....	
2,450	100	.....	.0009	
12,250	500	.0312	.....	
24,500	1,000	.0689	.....	
36,750	1,500	.1062	.....	
39,200	1,600	.1141	.....	
41,650	1,700	.1220	.....	
44,100	1,800	.1294	.....	
46,550	1,900	.1370	.....	
49,000	2,000	.1440	.....	E=2,655,000 pounds per square inch.
2,450	100	.....	.0009	
51,450	2,100	.1493	.....	
53,900	2,200	.1570	.....	
56,350	2,300	.1645	.....	
58,800	2,400	.1716	.....	
61,250	2,500	.1796	.....	E=2,662,000 pounds per square inch.
49,000	2,000	.1429	.....	
36,750	1,500	.1063	.....	
24,500	1,000	.0693	.....	
12,250	500	.0310	.....	
2,450	100	.....	—.0007	
12,250	500	.0298	.....	
24,500	1,000	.0673	.....	
36,750	1,500	.1049	.....	
49,000	2,000	.1420	.....	
61,250	2,500	.1791	.....	
49,000	2,000	.1424	.....	
36,750	1,500	.1060	.....	
24,500	1,000	.0689	.....	
12,250	500	.0292	.....	
2,450	100	.....	—.0010	

Stick No. 30.—6″ × 14″ by 24 feet long, split edgewise into two pieces, and each piece tested by tension.

No. 8514.

First piece from stick No. 30.
Dimensions, 13″.96 × 2″.78 by 24 feet, 3¼ inches long.
Average rate of growth, 14 rings per inch.
Counterweighted at the middle.
Sectional area, 38.8 square inches.
Gauged length, 200″.

End view.

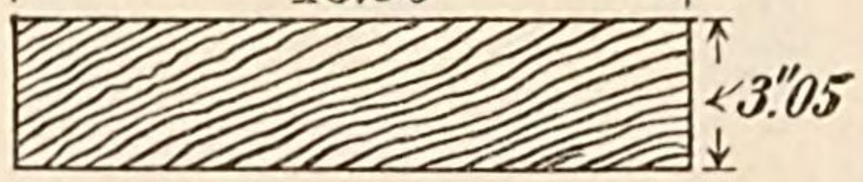


Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
3,880	100	0.	0.	Initial load.
7,760	200	.0106	.....	
11,640	300	.0213	.....	
15,520	400	.0319	.....	
19,400	500	.0427	.....	
3,880	100	.....	.0008	
23,280	600	.0532	.....	
27,160	700	.0637	.....	
31,040	800	.0746	.....	
34,920	900	.0853	.....	
38,800	1,000	.0957	.....	
3,880	100	.....	.0019	
42,680	1,100	.1057	.....	
46,560	1,200	.1162	.....	
50,440	1,300	.1275	.....	
54,320	1,400	.1380	.....	
58,200	1,500	.1487	.....	
38,800	1,000	.0978	.....	
19,400	500	.0461	.....	
3,880	100	.....	.0026	
.....	100	.....	.0015	After 1 hour.
19,400	500	.0439	.....	
38,800	1,000	.0958	.....	
58,200	1,500	.1483	.....	E=1,923,000 pounds per square inch.
38,800	1,000	.0975	.....	
19,400	500	.0454	.....	
3,880	100	.....	.0027	
19,400	500	.0442	.....	
38,800	1,000	.0962	.....	
58,200	1,500	.1482	.....	E=1,929,000 pounds per square inch.
38,800	1,000	.0979	.....	
19,400	500	.0459	.....	
3,880	100	.....	.0030	

No. 8544.

Second piece from stick No. 30.
Dimensions, 13″.96 × 3″.05 by 24′—3¼″ long.
Weight, 239¾ pounds=33.4 pounds per cubic foot.
Average rate of growth, 14 rings per inch.
Counterweighted at the middle.
Sectional area, 42.58 square inches.
Gauged length, 200″.

End view.



Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4, 258	100	0.	0.	Initial load.
8, 516	200	.0111	.....	
12, 774	300	.0223	.....	
17, 032	400	.0335	.....	
21, 290	500	.0450	.....	
25, 548	600	.0560	.....	
29, 806	700	.0675	.....	
34, 064	800	.0788	.....	
38, 322	900	.0904	.....	
42, 580	1, 000	.1015	.....	
46, 838	1, 100	.1124	.....	
4, 258	100	.....	.0010	
51, 096	1, 200	.1228	.....	
55, 354	1, 300	.1342	.....	
59, 612	1, 400	.1462	.....	
63, 870	1, 500	.1579	.....	
68, 128	1, 600	.1690	.....	E=1,787,000 pounds.
4, 258	100	.....	.0011	
72, 386	1, 700	.1795	.....	
76, 644	1, 800	.1916	.....	
80, 902	1, 900	.2035	.....	
85, 160	2, 000	.2152	.....	
89, 418	2, 100	.2265	.....	
4, 258	100	.....	.0007	
93, 676	2, 200	.2367	.....	
97, 934	2, 300	.2490	.....	
102, 192	2, 400	.2614	.....	
85, 160	2, 000	.2170	.....	
63, 870	1, 500	.1609	.....	E=1,763,000 pounds per square inch.
42, 580	1, 000	.1040	.....	
21, 290	500	.0473	.....	
4, 258	100	.....	.0005	
.....	100	.....	—.0012	After 5 minutes.
21, 290	500	.0430	.....	
42, 580	1, 000	.0994	.....	
63, 870	1, 500	.1570	.....	
85, 160	2, 000	.2139	.....	
63, 870	1, 500	.1590	.....	
42, 580	1, 000	.1024	.....	
21, 290	500	.0459	.....	
4, 258	100	.....	—.0004	
.....	100	.....	—.0022	After 10 minutes.
.....	100	.....	—.0032	After 15 hours.
8, 516	200	.0084	.....	
12, 774	300	.0196	.....	
17, 032	400	.0312	.....	
21, 290	500	.0429	.....	
17, 032	400	.0324	.....	
12, 774	300	.0215	.....	
8, 516	200	.0100	.....	
4, 258	100	.....	—.0021	
21, 290	500	.0421	.....	

No. 8544—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
42,580	1,000	.0989	.....	
63,850	1,500	.1560	.....	
85,160	2,000	.2138	.....	
102,192	2,400	.2622	.....	
85,160	2,000	.2174	.....	
63,870	1,500	.1616	.....	
42,580	1,000	.1052	.....	
21,290	500	.0485	.....	
4,258	100	.....	+.0005	
.....	100	.....	—.0008	After 3 minutes.

Lateral contraction under endwise tensile stresses.
Transverse gauged length at middle of length of stick, 12″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0020	.....	
85,160	2,000	.0050	.....	
102,192	2,400	.0063	.....	
85,160	2,000	.0052	.....	
42,580	1,000	.0023	.....	
4,258	100	.....	0.	
42,580	1,000	.0022	.....	
85,160	2,000	.0050	.....	
102,192	2,400	.0063	.....	
85,160	2,000	.0051	.....	
42,580	1,000	.0022	.....	
4,258	100	.....	0.	

Transverse gauged length 12″, taken near extremity A of the 200″ longitudinal gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
Pounds.	*Pounds.*	*Inch.*	Set.	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0016	.....	
85,160	2,000	.0036	.....	
102,192	2,400	.0044	.....	
85,160	2,000	.0036	.....	
42,580	1,000	.0016	.....	
4,258	100	.....	0.	

Transverse gauged length 12″, taken near extremity B of the 200″ longitudinal gauged length.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral contraction.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0039	.....	
85,160	2,000	.0081	.....	
102,192	2,400	.0101	.....	
85,160	2,000	.0084	.....	
42,580	1,000	.0041	.....	
4,258	100	.....	0.	

Observations on longitudinal extension resumed.
Gauged length 50″, taken at end A of the stick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0252	.....	
85,160	2,000	.0535	.....	
102,192	2,400	.0649	.....	
85,160	2,000	.0541	.....	
42,580	1,000	.0263	.....	
4,258	100	.....	.0005	

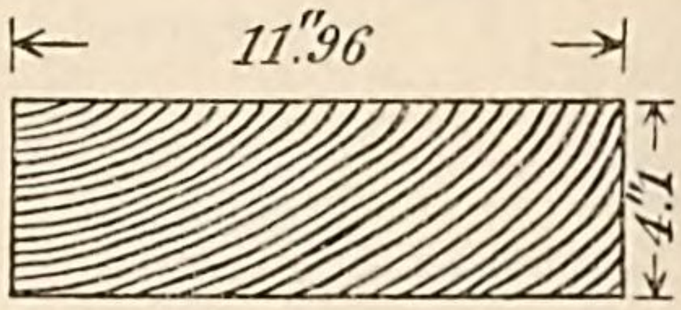
Gauged length 50″, taken at end B of the stick.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
42,580	1,000	.0257	.....	
85,160	2,000	.0543	.....	
102,192	2,400	.0660	.....	
85,160	2,000	.0551	.....	
42,580	1,000	.0263	.....	
4,258	100	.....	.0003	

No. 8543.

Stick No. 41.
Dimensions, 11″.96 × 4″.1 by 24′—$2\frac{5}{8}$″ long.
Weight, 328½ pounds=39.8 pounds per cubic foot.
Counterweighted at the middle.
Sectional area, 49.04 square inches.
Gauged length, 200″.

End view.



Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,904	100	0.	0.	Initial load.
9,808	200	.0117	.....	
14,712	300	.0234	.....	
19,616	400	.0351	.....	
24,520	500	.0469	.....	
29,424	600	.0590	.....	
34,328	700	.0710	.....	
39,232	800	.0829	.....	
44,136	900	.0948	.....	
49,040	1,000	.1070	.....	
53,944	1,100	.1189	.....	}
49,040	1,000	.1088	.....	|
44,136	900	.0975	.....	|
39,232	800	.0860	.....	|
34,328	700	.0743	.....	|
29,424	600	.0629	.....	} E = 1,739,000 pounds per square inch.
24,520	500	.0514	.....	|
19,616	400	.0396	.....	|
14,712	300	.0278	.....	|
9,808	200	.0160	.....	|
4,904	100	.....	.0039	}
.....	100	.....	.0032	After 3 minutes.
9,808	200	.0144	.....	
14,712	300	.0260	.....	
19,616	400	.0376	.....	
24,520	500	.0493	.....	
29,424	600	.0611	.....	
34,328	700	.0730	.....	
39,232	800	.0847	.....	
44,136	900	.0969	.....	
49,040	1,000	.1085	.....	
53,944	1,100	.1201	.....	
58,848	1,200	.1320	.....	
63,752	1,300	.1445	.....	
68,656	1,400	.1561	.....	
73,560	1,500	.1680	.....	
78,464	1,600	.1806	.....	
.....	1,600	.1811	.....	After 2 minutes.
83,368	1,700	.1933	.....	
88,272	1,800	.2050	.....	
				Stick slipped in the holder jaws of the machine, disturbing the micrometer.
				The micrometer was readjusted and the stress then released to initial load, and micrometer reading taken.
4,904	100	.....	.0139	
93,176	1,900	.2136	.....	} E = 1,780,000 pounds per square inch.
4,904	100	.....	.0114	}
93,176	1,900	.2132	.....	
4,904	100	.....	.0121	
.....	100	.....	.0082	After 1 hour.
9,808	200	.0194	.....	

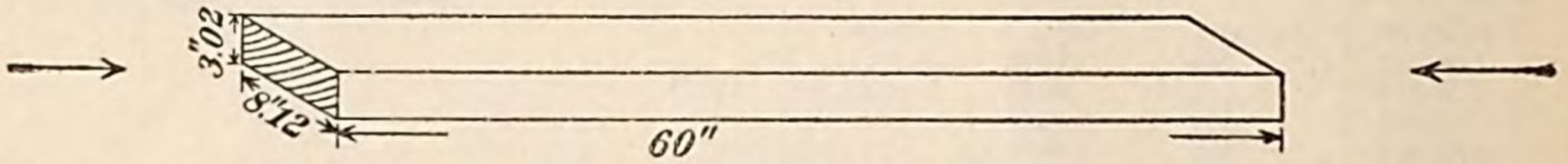
No. 8543—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
14,712	300	.0310	.....	
19,616	400	.0425	.....	
24,520	500	.0541	.....	
29,424	600	.0660	.....	
34,328	700	.0775	.....	
39,232	800	.0889	.....	
44,136	900	.1005	.....	
49,040	1,000	.1120	.....	
53,944	1,100	.1231	.....	
49,040	1,000	.1129	.....	
44,136	900	.1019	.....	
39,232	800	.0904	.....	
34,328	700	.0791	.....	
29,424	600	.0678	.....	
24,520	500	.0564	.....	
19,616	400	.0449	.....	
14,712	300	.0333	.....	
9,808	200	.0216	.....	
4,904	100	.....	.0098	Test discontinued.

Compression Tests.

No. 1449.

Stick No. 26.
Sample cut from tension specimen No. 8513.



Sectional area, $3''.02 \times 8''.12 = 24.5$ square inches.
Gauged length, $50''$.

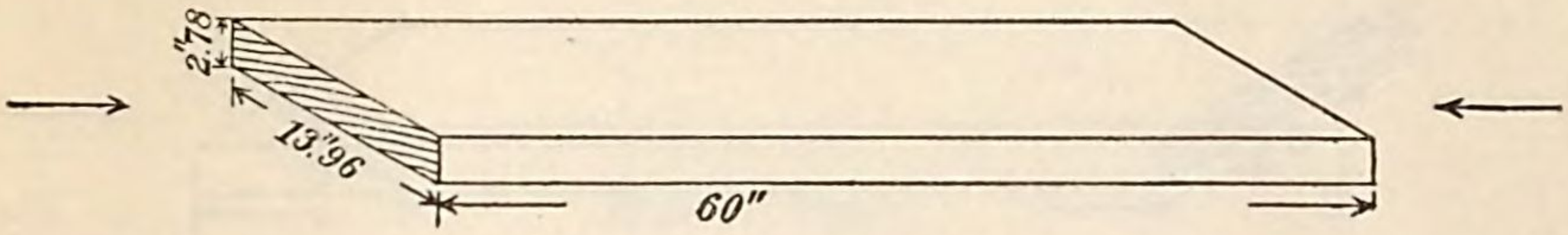
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,450	100	0.	0.	Initial load.
4,900	200	.0012	.....	
7,350	300	.0025	.....	
9,800	400	.0040	.....	
12,250	500	.0052	.....	
2,450	100	.....	.0001	
14,700	600	.0068	.....	
17,150	700	.0081	.....	
19,600	800	.0100	.....	
22,050	900	.0114	.....	
24,500	1,000	.0131	.....	E = 3,461,000 pounds per square inch.
2,450	100	.....	.0001	
29,400	1,200	.0162	.....	
34,300	1,400	.0195	.....	
39,200	1,600	.0229	.....	
44,100	1,800	.0260	.....	
49,000	2,000	.0294	.....	
2,450	100	.....	.0002	
53,900	2,200	.0323	.....	
58,800	2,400	.0356	.....	
63,700	2,600	.0390	.....	
68,600	2,800	.0423	.....	
73,500	3,000	.0455	.....	
2,450	100	.....	.0001	

Lateral expansion under endwise compression loads.
Transverse gauged length, $7''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,450	100	0.	0.	Initial load.
24,500	1,000	.0010	.....	
49,000	2,000	.0022	.....	
73,500	3,000	.0034	.....	
49,000	2,000	.0022	.....	
24,500	1,000	.0010	.....	
2,450	100	.....	0.	
193,100	7,882	.....	.....	Ultimate strength. Failed by triple flexure.

No. 1450.

Stick No. 30.
Sample cut from tension specimen No. 8514.



Sectional area, $2''.78 \times 13''.96 = 38.8$ square inches.
Gauged length, $50''$.

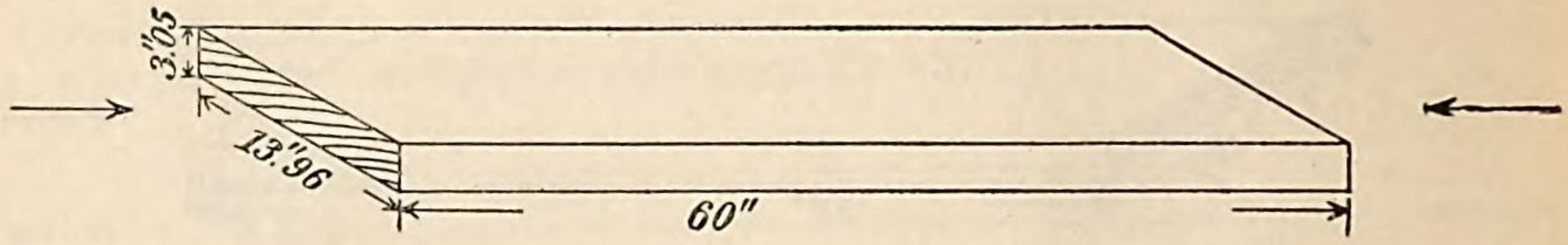
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
3,880	100	0.	0.	Initial load.
7,760	200	.0020	.....	
11,640	300	.0043	.....	
15,520	400	.0066	.....	
19,400	500	.0092	.....	
3,880	100	.....	—.0004	
23,280	600	.0118	.....	
27,160	700	.0143	.....	
31,040	800	.0168	.....	
34,920	900	.0194	.....	
38,800	1,000	.0219	.....	E=2,018,000 pounds per square inch.
3,880	100	.....	—.0004	
46,560	1,200	.0266	.....	
54,320	1,400	.0316	.....	
62,080	1,600	.0369	.....	
69,840	1,800	.0421	.....	
77,600	2,000	.0471	.....	
3,880	100	.....	.0000	
85,360	2,200	.0520	.....	
93,120	2,400	.0571	.....	
100,880	2,600	.0623	.....	
108,640	2,800	.0686	.....	
116,400	3,000	.0729	.....	
3,880	100	.....	.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, $12''$.

Applied loads.		In guaged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
3,880	100	0.	0.	Initial load.
38,800	1,000	.0025	.....	
77,600	2,000	.0057	.....	
116,400	3,000	.0092	.....	
93,120	2,400	.....	.....	Rested 1 hour.
77,600	2,000	.0065	.....	
38,800	1,000	.0031	.....	
3,880	100	.....	.0005	
38,800	1,000	.0031	.....	
77,600	2,000	.0064	.....	
116,400	3,000	.0098	.....	
77,600	2,000	.0065	.....	
38,800	1,000	.0032	.....	
3,880	100	.....	.0006	
241,000	6,211	.....	.....	Ultimate strength. Failed by triple flexure.

No. 1451.

Stick No. 30.
Sample cut from tension specimen No. 8544.



Sectional area, $3''.05 \times 13''.96 = 42.58$ square inches.
Gauged length, $50''$.

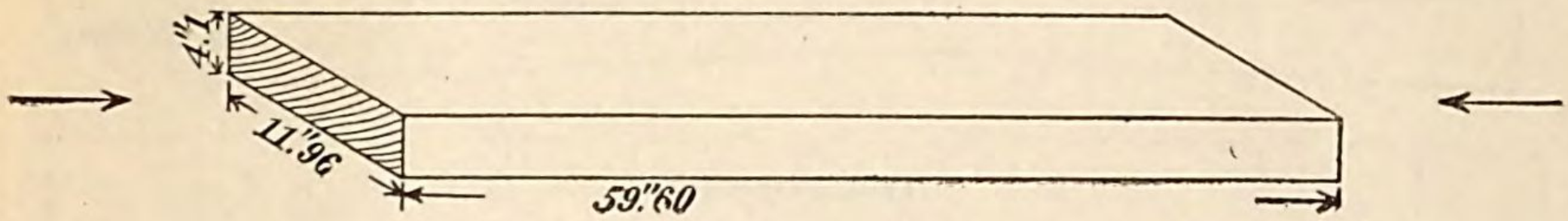
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
8,516	200	.0020	.....	
12,774	300	.0045	.....	
17,032	400	.0069	.....	
21,290	500	.0095	.....	
4,258	100	.....	—.0004	
25,548	600	.0121	.....	
29,806	700	.0146	.....	
34,064	800	.0174	.....	
38,322	900	.0201	.....	
42,580	1,000	.0230	.....	E = 1,915,000 pounds per square inch.
4,258	100	.....	—.0005	
51,096	1,200	.0282	.....	
59,612	1.400	.0337	.....	
68,128	1,600	.0395	.....	
76,644	1,800	.0450	.....	
85,160	2,000	.0506	.....	
4,258	100	.....	—.0002	
93,676	2,200	.0557	.....	
102,192	2,400	.0614	.....	
110,708	2,600	.0670	.....	
119,224	2,800	.0727	.....	
127,740	3,000	.0782	.....	
.....	100	.....	.0000	

Lateral expansion under endwise compression loads.
Transverse gauged length, $12''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,258	100	0.	0.	Initial load.
42,580	1,900	.0033	.....	
85,160	2,000	.0071	.....	
127,740	3,000	.0111	.....	
85,160	2,000	.0074	.....	
42,580	1,000	.0035	.....	
4,258	100	.....	.0002	
127,740	3,000	.0111	.....	
.....	3,000	.0116	.....	After 5 minutes.
.....	3,000	.0118	.....	After 10 minutes.
4,258	100	.....	.0005	
237,100	5,568	.....	.....	Ultimate strength. Failed by triple flexure.

No. 1452.

Stick No. 41.
Sample cut from tension specimen No. 8543.



Sectional area, $4''.1 \times 11''.96 = 49.04$ square inches.
Gauged length, $50''$.

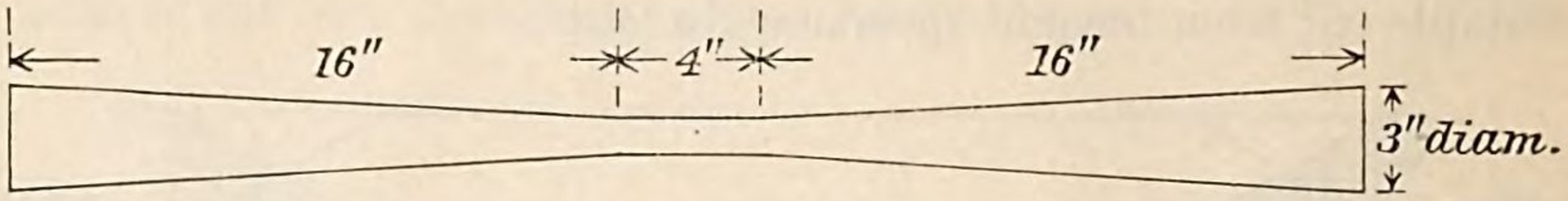
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,904	100	0.	0.	Initial load.
9,808	200	.0021	.....	
14,712	300	.0044	.....	
19,616	400	.0068	.....	
24,520	500	.0092	.....	
4,904	100	.....	—.0004	
29,424	600	.0117	.....	
34,328	700	.0141	.....	
39,232	800	.0166	.....	
44,136	900	.0191	.....	
49,040	1,000	.0216	.....	E = 2,036,000 pounds per square inch.
4,904	100	.....	—.0005	
58,848	1,200	.0261	.....	
68,656	1,400	.0314	.....	
78,464	1,600	.0364	.....	
88,272	1,800	.0415	.....	
98,080	2,000	.0466	.....	
4,904	100	.....	—.0004	
107,888	2,200	.0514	.....	
117,696	2,400	.0568	.....	
127,504	2,600	.0620	.....	
137,312	2,800	.0674	.....	
147,120	3,000	.0726	.....	
4,904	100	.....	+.0004	

Lateral expansion under endwise compression loads.
Transverse gauged length, $10''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,904	100	0.	0.	Initial load.
49,040	1,000	.0017	.....	
98,080	2,000	.0036	.....	
147,120	3,000	.0057	.....	
98,080	2,000	.0038	.....	
49,040	1,000	.0020	.....	
4,904	100	.....	.0002	
305,050	6,220	.....	.....	Ultimate strength.

Failed by triple flexure. Fibers crushed $12''$ from end of stick.

TENSION TESTS.



No. of test.	No. of stick.	Diameter.	Sectional area.	Tensile strength.		Fracture.
				Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	
8554	26	1.02	0.817	19,720	24,137	Long splintering.
8555	26	1.02	.817	18,100	22,154	Do.
8556	26	1.02	.817	18,150	22,215	Do.
8557	(1st) 30	.98	.754	9,620	12,759	Sheared along the grain. Stick not fractured by tension.
8558	(1st) 30	1.01	.801	9,100	11,361	Short brittle.
8559	(1st) 30	1	.785	9,520	12,127	Oblique. In part sheared along the grain.
8560	(2d) 30	.99	.770	9,460	12,286	Short brittle, oblique.
8561	(2d) 30	.99	.770	9,020	11,714	Sheared along the grain.
8562	(2d) 30	.98	.754	8,310	11,021	Short brittle.
8566	(2d) 30	1	.785	9,460	12,051	Sheared along the grain.
8607	26	1	.785	16,200	20,637	Sheared along the grain, pulling out an irregular shaped core about $\frac{3}{4}''$ by $1\frac{1}{4}''$ in cross-section dimensions. Tensile strength not reached.
8608	26	1	.785	17,310	22,051	Long splintering.
8609	26	.98	.754	17,980	23,846	In part long splintering and in part sheared the wood along the grain.
8610	30	.98	.754	9,100	12,069	Oblique fracture. Sheared along the grain.
8611	30	.98	.754	6,320	8,382	Do.
8612	30	.98	.754	8,100	10,742	Do.
8613	41	1	.785	6,020	7,669	Do.
8614	41	.97	.739	6,950	9,405	Do.
8615	41	.98	.754	5,660	7,507	Do.

No. 8566 tested wet, after 48 hours immersion in water.

Specimens 8607 to 8615, inclusive, were turned out and tested two months later than the tension specimens previously tested.

WHITE OAK WOOD

FROM

C. C. MENGEL, JR., & BRO., LOUISVILLE, KY.

WHITE OAK WOOD.

These sticks were tested under compression loads applied endwise the grain, excepting a block taken from post No. 1422, which was loaded crosswise the grain in the direction radial to the tree. Micrometer observations were made on the compressibility of the wood in each test, from which results the moduli of elasticity were computed.

The relative rigidity of the wood lengthwise and crosswise the grain is shown by the results from post No. 1422, which gave the value 1,675,000 pounds per square inch for the modulus of elasticity under endwise loads, and 210,000 pounds per square inch for the value under loads crosswise the grain.

The compressibility of post No. 1418 was observed under continued stress at 3,000 pounds per square inch. There was comparatively rapid yielding during the first five minutes, which diminished in rate during the next ten minutes.

During the interval of one hour following, the rate of compression continued with considerable uniformity. The post thereafter showed an accelerating rate of yielding.

After the lapse of one hour and thirty minutes the load was diminished in decrements of 200 pounds per square inch each. After each decrement the load was sustained two minutes.

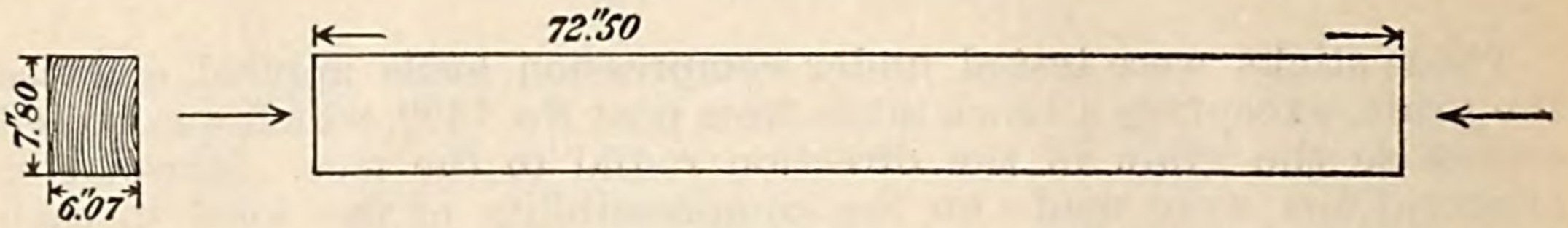
Under 2,800 pounds per square inch a further compression of ″.0031 occurred; under 2,600 pounds per square inch the additional compression was ″.0005; under 2,400 pounds per square inch no change in the gauged length was apparent, and under the subsequent lower stresses the effect of each pause of two minutes was a gain in length instead of additional compression.

After the loads were diminished to 1,600 pounds per square inch they were again increased, with the result that under 2,000 pounds per square inch and upward each interval of two minutes was accompanied by additional yielding, which proceeded with an accelerating rate as the loads advanced.

The ultimate resistance of this post reached 3,508 pounds per square inch, which load was momentarily sustained. Its behavior under 3,000 pounds per square inch indicated that ultimate failure might have been reached by longer continuance under stress at that limit.

Compression Tests.

No. 1418.



Sectional area, 47.35 square inches.
Weight, 95¼ pounds = 47.9 pounds per cubic foot.
Rate of growth, 12 rings per inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,735	100	0.	0.	Initial load.
9,470	200	.0036	.....	
14,205	300	.0072	.....	
18,940	400	.0109	.....	
23,675	500	.0148	.....	
28,410	600	.0188	.....	
33,145	700	.0224	.....	
37,880	800	.0261	.....	
42,615	900	.0304	.....	
47,350	1,000	.0341	.....	
4,735	100	.....	.0008	
56,820	1,200	.0414	.....	
66,290	1,400	.0491	.....	
75,760	1,600	.0573	.....	
85,230	1,800	.0655	.....	
142,050	3,000	.2401	.....	After 1 hour 10 minutes.
.....	3,000	.2470	.....	After 1 hour 15 minutes.
.....	3,000	.2551	.....	After 1 hour 20 minutes.
.....	3,000	.2657	.....	After 1 hour 25 minutes.
.....	3,000	.2809	.....	After 1 hour 30 minutes.

Post shows evidence of crushing the fibers in the vicinity of some sound knots.

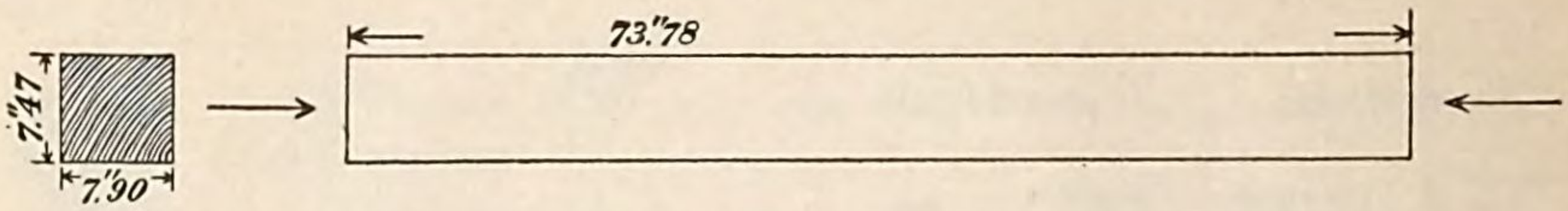
Compression Tests—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
132,580	2,800	0.2748	.....	
.....	2,800	.2779	.....	After 2 minutes.
123,110	2,600	.2706	.....	
.....	2,600	.2712	.....	Do.
113,640	2,400	.2634	.....	
.....	2,400	.2634	.....	Do.
104,170	2,200	.2553	.....	
.....	2,200	.2550	.....	Do.
94,700	2,000	.2469	.....	
.....	2,000	.2461	.....	Do.
85,230	1,800	.2375	.....	
.....	1,800	.2366	.....	Do.
75,760	1,600	.2280	.....	
.....	1,600	.2267	.....	Do.
85,230	1,800	.2345	.....	
.....	1,800	.2344+	.....	Do.
94,700	2,000	.2427	.....	
.....	2,000	.2430	.....	Do.
104,170	2,200	.2515	.....	
.....	2,200	.2520	.....	Do.
94,700	2,000	.0741	.....	E = 1,338,000 pounds per square inch.
4,735	100	.....	.0031	
104,170	2,200	.0839	.....	
113,640	2,400	.0933	.....	
123,110	2,600	.1051	.....	
132,580	2,800	.1177	.....	
142,050	3,000	.1380	.....	
94,700	2,000	.1010	.....	
47,350	1,000	.0589	.....	
4,735	100	.....	.0184	
47,350	1,000	.0537	.....	
94,700	2,000	.0950	.....	
142,050	3,000	.1394	.....	
.....	3,000	.1454	.....	After 1 minute.
.....	3,000	.1488	.....	After 2 minutes.
.....	3,000	.1530	.....	After 3 minutes.
.....	3,000	.1565	.....	After 5 minutes.
.....	3,000	.1653	.....	After 10 minutes.
.....	3,000	.1725	.....	After 15 minutes.
.....	3,000	.1788	.....	After 20 minutes.
.....	3,000	.1848	.....	After 25 minutes.
.....	3,000	.1910	.....	After 30 minutes.
.....	3,000	.1972	.....	After 35 minutes.
.....	3,000	.2034	.....	After 40 minutes.
.....	3,000	.2096	.....	After 45 minutes.
.....	3,000	.2156	.....	After 50 minutes.
.....	3,000	.2216	.....	After 55 minutes.
.....	3,000	.2278	.....	After 60 minutes.
.....	3,000	.2336	.....	After 1 hour 5 minutes.
113,640	2,400	.2602	.....	
.....	2,400	.2612	.....	
123,110	2,600	.2697	.....	
.....	2,600	.2715	.....	
132,580	2,800	.2807	.....	
.....	2,800	.2853	.....	
142,050	3,000	.2960	.....	
166,100	3,508	.....	.....	Maximum load sustained.

The interval of time between the last reading of the micrometer under 3,000 pounds per square inch and the time of reaching the maximum load was one minute.

Failure occurred by the fibers crushing at some knots $1\frac{1}{2}''$ diameter $30''$ from the end of the post.

No. 1419.

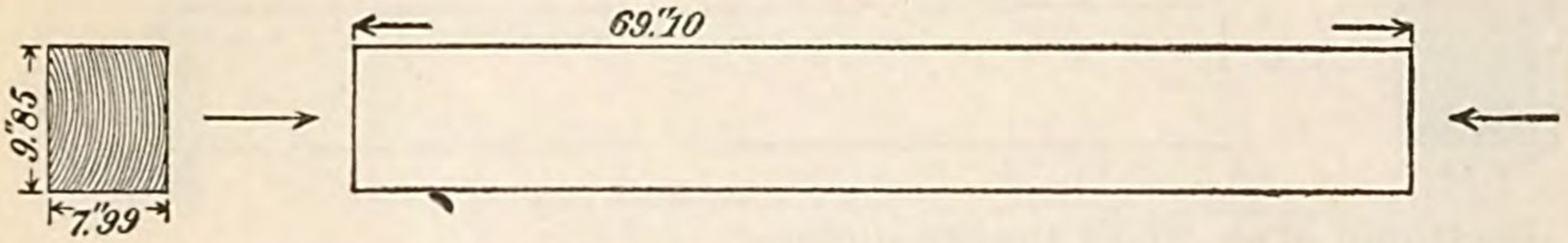


Sectional area, 59.01 square inches.
Weight, 123¾ pounds = 49 pounds per cubic foot.
Rate of growth, 11 rings per inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
5,901	100	0.	0.	Initial load.
11,802	200	.0050	.....	
17,703	300	.0094	.....	
23,604	400	.0137	.....	
29,505	500	.0174	.....	
35,406	600	.0212	.....	
41,307	700	.0247	.....	
47,208	800	.0285	.....	
53,109	900	.0321	.....	
59,010	1,000	.0355	.....	
5,901	100	.....	.0011	
70,812	1,200	.0424	.....	
82,614	1,400	.0495	.....	
94,416	1,600	.0564	.....	
106,218	1,800	.0637	.....	
118,020	2,000	.0710	.....	E = 1,399,000 pounds per square inch.
5,901	100	.....	.0031	
129,822	2,200	.0782	.....	
141,624	2,400	.0855	.....	
153,426	2,600	.0938	.....	
165,228	2,800	.1023	.....	
177,030	3,000	.1141	.....	
5,901	100	.....	.0103	
188,832	3,200	.1243	.....	
200,634	3,400	.1335	.....	
212,436	3,600	.1457	.....	
224,238	3,800	.1642	.....	
236,040	4,000	.1911	.....	
5,901	100	.....	.0320	
247,842	4,200	.2340	.....	
258,000	4,372	.....	.....	Ultimate strength.

Fibers crushed at a knot one-half inch diameter 20″ from end of post.

No. 1420.

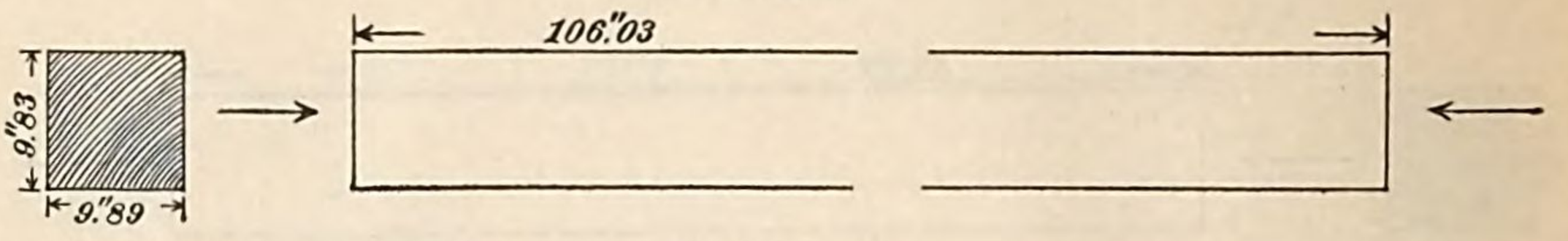


Sectional area, 78.7 square inches.
Weight, 162 pounds = 51.5 pounds per cubic foot.
Rate of growth, 12 rings per inch.
Gauged length, 50″.
The post was convex on the micrometer side.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,870	100	0.	0.	Initial load.
15,740	200	.0027	.....	
23,610	300	.0055	.....	
31,480	400	.0084	.....	
39,350	500	.0111	.....	
47,220	600	.0140	.....	
55,090	700	.0170	.....	
62,960	800	.0197	.....	
70,830	900	.0226	.....	
78,700	1,000	.0253	.....	
7,870	100	.....	0.	
94,440	1,200	.0310	.....	
110,180	1,400	.0367	.....	
125,920	1,600	.0422	.....	
141,660	1,800	.0480	.....	
157,400	2,000	.0537	.....	E = 1,789,000 pounds per square inch.
7,870	100	.....	.0006	E = 1,789,000 pounds per square inch.
173,140	2,200	.0596	.....	
188,880	2,400	.0659	.....	
204,620	2,600	.0720	.....	
220,360	2,800	.0784	.....	
236,100	3,000	.0856	.....	
7,870	100	.....	.0033	
251,840	3,200	.0935	.....	
267,580	3,400	.1014	.....	
283,320	3,600	.1114	.....	
299,060	3,800	.1249	.....	
314,800	4,000	.1545	.....	
7,870	100	.....	.0196	
318,100	4,042	.....	.....	Ultimate strength.

Fibers crushed at a knot three-eighths inch diameter 2 feet from the end of the post.

No. 1421.

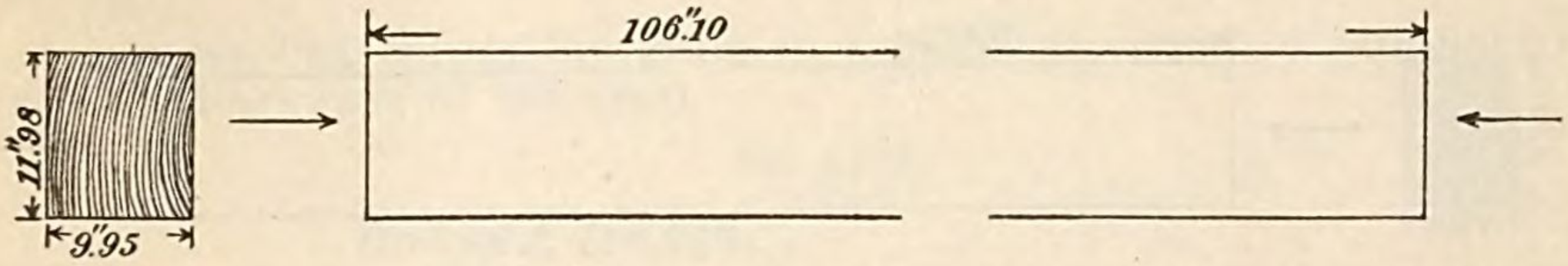


Sectional area, 97.22 square inches.
Weight, 341½ pounds = 57.2 pounds per cubic foot.
Rate of growth, 7 rings per inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
9,722	100	0.	0.	Initial load.
19,444	200	.0026	.....	
29,166	300	.0053	.....	
38,888	400	.0080	.....	
48,610	500	.0110	.....	
58,332	600	.0140	.....	
68,054	700	.0170	.....	
77,776	800	.0201	.....	
87,498	900	.0231	.....	
97,220	1,000	.0260	.....	
9,722	100	.....	.0004	
116,664	1,200	.0320	.....	
136,108	1,400	.0381	.....	
155,552	1,600	.0443	.....	
174,996	1,800	.0505	.....	
194,440	2,000	.0567	.....	E = 1,718,000 pounds per square inch.
9,722	100	.....	.0014	
213,884	2,200	.0634	.....	
233,328	2,400	.0700	.....	
252,772	2,600	.0766	.....	
272,216	2,800	.0838	.....	
291,660	3,000	.0919	.....	
9,722	100	.....	.0039	
311,104	3,200	.0990	.....	
330,548	3,400	.1080	.....	
349,992	3.600	.1193	.....	
369.436	3,800	.1356	.....	
388,880	4,000	.1680	.....	
9,722	100	.....	.0220	
411,200	4,230	.....	.....	Ultimate strength.

Fibers crushed at knots one-half inch diameter 32 inches from the end of the post.

No. 1422.

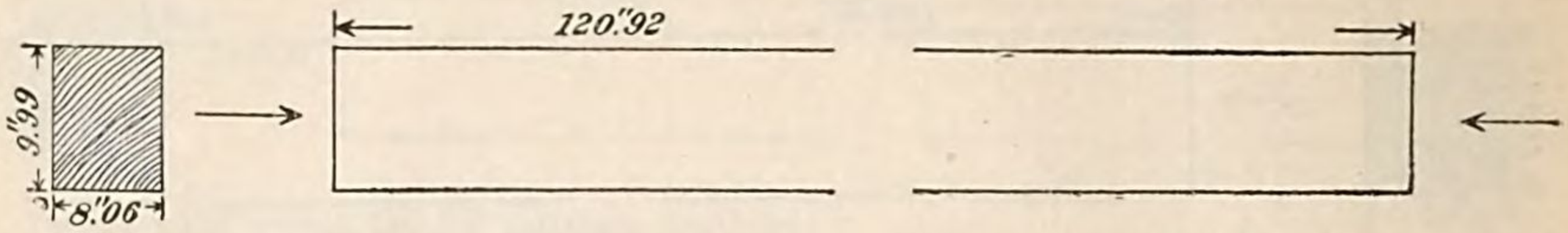


Sectional area, 119.2 square inches.
Weight, 415½ pounds=56.8 pounds per cubic foot.
Rate of growth, 14 rings per inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
11,920	100	0.	0.	Initial load.
23,840	200	.0025	.....	
35,760	300	.0051	.....	
47,680	400	.0080	.....	
59,600	500	.0109	.....	
71,520	600	.0140	.....	
83,440	700	.0170	.....	
95,360	800	.0201	.....	
107,280	900	.0231	.....	
119,200	1,000	.0260	.....	
11,920	100	.....	.0003	
143,040	1,200	.0322	.....	
166,880	1,400	.0384	.....	
190,720	1,600	.0446	.....	
214,560	1,800	.0511	.....	
238,400	2,000	.0581	.....	} E = 1,675,000 pounds per square inch.
11,920	100	.....	.0014	
262,240	2,200	.0639	.....	
286,080	2,400	.0706	.....	
309,920	2,600	.0772	.....	
333,760	2,800	.0844	.....	
357,600	3,000	.0925	.....	
11,920	100	.....	.0031	
381,440	3,200	.0992	.....	
405,280	3,400	.1084	.....	
429,120	3,600	.1181	.....	
452,960	3,800	.1293	.....	
476,800	4,000	.1515	.....	
11,920	100	.....	.0117	
500,300	4,197	.....	.....	Ultimate strength.

Fibers crushed at a knot three-eighths inch diameter 30 inches from the end of the stick.

No. 1423.



Sectional area, 79.92 square inches.
Weight, 291 pounds=52 pounds per cubic foot.
Rate of growth, 9 rings per inch.
Gauged length, 50″.

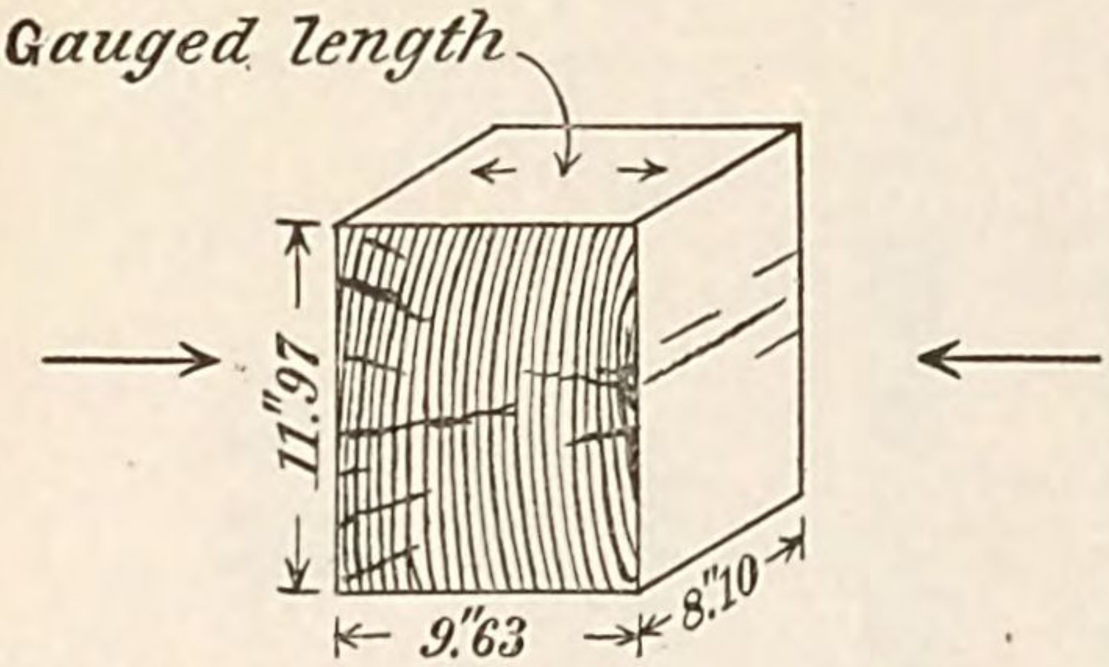
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,992	100	0.	0.	Initial load.
15,984	200	.0041	.....	
23,976	300	.0082	.....	
31,968	400	.0120	.....	
39,960	500	.0156	.....	
47,952	600	.0195	.....	
55,944	700	.0230	.....	
63,936	800	.0265	.....	
71,928	900	.0300	.....	
79,920	1,000	.0336	.....	
7,992	100	.....	.0015	
95,904	1,200	.0408	.....	
111,888	1,400	.0481	.....	
127,872	1,600	.0554	.....	
143,856	1,800	.0631	.....	
159,840	2,000	.0715	.....	E=1,407,000 pounds per square inch.
7,992	100	.....	.0040	
175,824	2,200	.0798	.....	
191,808	2,400	.0880	.....	
207,792	2,600	.0981	.....	
223,776	2,800	.1123	.....	
239,760	3,000	.1225	.....	
7,992	100	.....	.0120	
255,744	3,200	.1421	.....	
271,728	3,400	.1896	.....	
295,500	3,697	.....	.....	Ultimate strength.

Fibers crushed at a group of knots 4 feet from the end of the post. The knots range from one-fourth inch to 1 inch diameter, and were four in number.

Compression of a sample taken from the middle of the length of post No. 1422.

Loads applied across the grain in a radial direction, or parallel to the medullary rays of the wood.

No. 1424.



Sectional area, $11''.97 \times 8''.10 = 96.96$ square inches.
Gauged length, $6''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,939	20	0.	0.	Initial load.
3,878	40	.0009	.....	
5,817	60	.0017	.....	
7,756	80	.0025	.....	
9,696	100	.0032	.....	
1,939	20	.....	.0004	
11,635	120	.0036	.....	
13,574	140	.0043	.....	
15,513	160	.0049	.....	
17,452	180	.0054	.....	
19,392	200	.0060	.....	
1,939	20	.....	.0005	
21,331	220	.0065	.....	
23,270	240	.0070	.....	
25,209	260	.0075	.....	
27,148	280	.0082	.....	
29,088	300	.0088	.....	
1,939	20	.....	.0007	
31,027	320	.0091	.....	
32,966	340	.0099	.....	
34,905	360	.0105	.....	
36,844	380	.0112	.....	
38,784	400	.0118	.....	
1,939	20	.....	.0009	
40,723	420	.0121	.....	
42,662	440	.0129	.....	
44,601	460	.0137	.....	
46,540	480	.0143	.....	
48,480	500	.0151	.....	} E = 210,000 pounds per square inch.
1,939	20	.....	.0014	
50,419	520	.0156	.....	
52,358	540	.0163	.....	
54,297	560	.0171	.....	
56,236	580	.0178	.....	
58,176	600	.0186	.....	
1,939	20	.....	.0020	
.....	20	.....	.0011	After ½ hour rest.
60,115	620	.0194	.....	
62,054	640	.0204	.....	
63,993	660	.0214	.....	
65,932	680	.0225	.....	
67,872	700	.0236	.....	
.....	700	.0255	.....	After 5 minutes.
.....	700	.0266	.....	After 10 minutes.
1,939	20	.....	.0051	
.....	20	.....	.0035	After 15 minutes.
67,872	700	.0250	.....	
69,811	720	.0268	.....	
71,750	740	.0281	.....	
73,689	760	.0292	.....	
75,628	780	.0305	.....	

No. 1424—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
77,568	800	.0328	.....	
1,939	20	.....	.0062	
79,507	820	.0342	.....	
81,446	840	.0376	.....	
83,385	860	.0399	.....	
85,324	880	.0431	.....	
87,264	900	.0461	.....	
.....	900	.0567	.....	After 5 minutes.
1,939	20	.....	.0151	
.....	20	.....	.0123	After 5 minutes.
.....	20	.....	.0118	After 8 minutes.
9,696	100	.0140	.....	
19,392	200	.0173	.....	
29,088	300	.0210	.....	
38,784	400	.0250	.....	
48,480	500	.0298	.....	
58,176	600	.0353	.....	
67,872	700	.0418	.....	
77,568	800	.0485	.....	
.....	800	.0524	.....	After 5 minutes.
.....	800	.0576	.....	After 15 minutes.
1,939	20	.....	.0207	
77,568	800	.0569	.....	
87,264	900	.0634	.....	
89,203	920	.0675	.....	
91,142	940	.0719	.....	
93,081	960	.0760	.....	
95,020	980	.0811	.....	
96,960	1,000	.0912	.....	
.....	1,000	.1090	.....	After 5 minutes.
106,656	1,100	.15	.....	Moisture shows on end of stick.
116,352	1,200	.27	.....	
126,048	1,300	.42	.....	
135,744	1,400	.58	.....	
145,440	1,500	.72	.....	
155,136	1,600	.....	.....	Ultimate strength.

Sustained the maximum load one-half minute then failed rapidly under diminished loads, by the stick yielding rapidly, splitting along the grain.

CHEMICAL ANALYSES OF STEEL AND CAST IRON.

CHEMICAL ANALYSES.

STEELS FROM SPRINGFIELD ARMORY.

Tension test number.	Description.	Marks.	Carbon.	Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Nickel.	Remarks.
	Bars for illustrating differences in effect of nitre treatment for bluing steel.	1	0.362	0.313	0.276	0.054	0.083	0.230	.....	30 per cent of surface blued.
		2	0.502	0.300	0.223	0.052	0.065	0.050	.....	45 per cent of surface blued.
		3	0.284	0.560	0.023	0.106	0.057	0.150	.....	Uniformly blued.
		4	0.375	0.439	0.209	0.102	0.057	0.150	.....	Nearly uniformly blued.
		5	0.176	0.706	0.021	0.100	0.052	0.042	.....	Uniformly blued.
		6	0.423	0.826	0.197	0.049	0.073	0.050	.....	50 per cent of surface blued.
	Turned and drilled rifle barrel.....	32	0.887	0.940	0.116	0.090	0.062	.....	.....	Attacked slowly by dilute sulphuric acid.
	.....do	28	0.516	0.489	0.126	0.050	0.107	.....	.....	Attacked rapidly by dilute sulphuric acid.
	From rifle barrel that burst while firing.	7453	0.511	0.814	0.301	0.040	0.121	0.021	.....	Taken 10″ from breech end.
		7453	0.511	0.871	.....	0.045	.....	.....	.....	Taken 1″ to 2½″ from breech end.
5399 5401	Nickel steel for rifle barrels.....	45	0.357	0.763	0.165	0.020	0.023	0.050	3.97	
		47	0.395	0.677	0.124	0.025	0.023	0.047	3.80	
5520 5521	Nickel steel for rifle barrels.....	58–2	0.707	0.325	0.188	0.030	0.041	0.040	3.170	
		59–3	0.837	0.352	0.116	0.042	0.064	0.040	3.287	
	For receivers of rifles.....	.....	0.217	1.284	0.027	0.142	0.066	.....	.....	
	For bands	.....	0.170	1.007	0.017	0.140	0.055	.....	.....	

Tension test number.	Description.	Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
			Total.	Graphitic.	Combined.					
.....	Steel castings for 12″ gun lift carriage	$\left\{\begin{matrix}12\ C_2\ F\ C\\ T_2\ M\end{matrix}\right\}$	.....	.....	0.270	0.630	0.240	0.035	0.035	0.090
.....	.....do	$\left\{\begin{matrix}36\ M\ R_1\ C\\ L_1\end{matrix}\right\}$	.....	.....	0.237	0.685	0.346	0.034	0.033	0.087
.....	.....do	$\left\{\begin{matrix}36\ M\ R_2\ C\\ L_1\end{matrix}\right\}$	.....	.....	0.261	0.610	0.246	0.030	0.033	0.091
5464	Cast iron with alloy	.....	2.971	2.037	0.934	0.458	1.222	0.090	0.578	..000
5465	.....do	.....	2.836	1.656	1.280	0.436	0.865	0.150	0.534	0.000
5466	.....do	.....	2.795	2.394	0.401	0.445	1.220	0.093	0.569	0.000
.....	10″ round shot (old)	.....	3.136	2.999	0.137	0.515	2.885	0.015	0.436	.....

STEEL USED IN CONSTRUCTION OF ROCK ISLAND BRIDGE.

Heat No.	Description.	Manufacturers.	Location in bridge.	Carbon.	Manganese.	Silicon.	Phosphorus.
1543	Coupon. Cast steel	Phœnix Iron Co., Phœnixville, Pa.	Draw roller wheel	0.464	0.348	0.136	0.055
4364	15″ × $\frac{9}{16}$″ ⌒	do	Solid floor trough	0.213	0.595	0. 15	0.024
2683	6″ × 6″ × $\frac{27}{32}$″ angle	do			0.313	0.019	0.028
2712	15″ × 130″ channel	do		0.260	0.451	0.014	0.005
3104	15″ × 117″ I-beam	do	Roadway stringers	0.333	0.307	0.011	0.032
3080	4″ × 4″ × $\frac{9}{16}$″ angle	do	Top chord flanges	0.254	0.335	0.022	0.005
2703	6″ × 6″ × $\frac{3}{4}$″ angle	do	Drum flanges	0.327	0.282	0.022	0.029
2790	32″ × 3½″ × $\frac{3}{8}$″ ⌊s	do	R. R. floor beams	0.240	0.457	0.015	0.020
1744	15″ × $\frac{9}{16}$″ ⌒	do	Solid floor trough	0.186	0.533	0.015	0.068
4237	4″ × 4″ × $\frac{11}{16}$″ angle	do		0.313	0.466	0.011	0.026
3100	6″ × 6″ × $\frac{5}{8}$″ angle	do	Central post flanges	0.292	0.401	0.017	0.026
4259	15″ × 117″ I-beam	do	Roadway stringers	0.340	0.413	0.017	0.030
1606	5″ × 3½″ × ½″ angle	do	Roadway floor beam flange	0.238	0.440	0.019	0.073
1621	5″ × 3½″ × $\frac{9}{16}$″ angle	do	R. R. stringer flange	0.211	0.484	0.019	0.041
3777	4″ × ¾″ flat	do	Drum stiffener filler	0.266	0.284	0.017	0.037
1618	5″ × 3½″ × $\frac{9}{16}$″ angle	do	R. R. stringer flange	0.209	0.503	0.019	0.059
4268	5″ × 1⅛″ flat	do	Counter bars	0.301	0.491	0.019	0.026
1719	4″ × 3″ × ⅜″ angle	do	End post lattice	0.247	0.580	0.020	0.055
3180	6″ × 4″ × $\frac{13}{16}$″ angle	do	Top chord flange	0.181	0.387	0.016	0.020
4348	do	do	do	0.260	0.581	0.022	0.019
2783	do	do	do	0.239	0.400	0.005	0.018
4350	3½″ × 3½″ × $\frac{9}{16}$″ angle	do		0.250	0.477	0.007	0.020
1730	4″ × 4″ × ⅝″ angle	do	Chord flange	0.248	0.592	0.021	0.060
2797	do	do	do	0.174	0.475	0.009	0.016
3186	15″ × $\frac{9}{16}$″ ⌒	do	Solid floor trough	0.155	0.402	0.018	0.016
4358	do	do	do	0.151	0.474	0.006	0.022
3193	do	do	do	0.142	0.350	0.006	0.015
1738	6″ × 6″ × ½″ angle	do	R. R. floor beam stiffener	0.205	0.530	0.022	0.067
1741	do	do	do	0.200	0.542	0.020	0.068
4307	15″ × $\frac{9}{16}$″ ⌒	do	Solid floor trough	0.120	0.350	0.008	0.020
3199	do	do	do	0.155	0.419	0.018	0.032
3198	do	do	do	0.100	0.423	0.010	0.016
1712	do	do	do	0.105	0.272	0.010	0.049
2717	16″ × ¾″ plate	Carbon Steel Co., Pittsburg, Pa.				0.010	0.080
2792	66″ × ½″ plate	do	Center bracing ties	0.220	0.348	0.016	0.071
2854	20″ × ⅜″ plate	do	Solid floor rail plates	0.165	0.484	0.014	0.072
2699	26″ × ½″ plate	do		0.185	0.445	0.014	0.071
2866	14¼″ × ¾″ plate	do	End post pin plates	0.264	0.309	0.023	0.072
2882	36″ × ⅝″ plate	do	R. R. stringers web	0.270	0.362	0.011	0.068
2884	do	do	do	0.291	0.451	0.010	0.071
2858	20″ × ⅜″ plate	do	Solid floor rail plates	0.279	0.360	0.011	0.077
2879	36″ × ⅜″ plate	do	R. R. stringers web	0.378	0.450	0.014	0.074

Steel used in construction of Rock Island Bridge—Continued.

Heat No.	Description.	Manufacturers.	Location in bridge.	Carbon.	Manganese.	Silicon.	Phosphorus.
2892	25½″ × ¼″ plate	Carbon Steel Co., Pittsburg, Pa.	Fillers	0.160	0.309	0.010	0.070
2969	33″ × 3/8″ plate	do	Top chord covers	0.140	0.291	0.014	0.068
2961	36″ × 3/8″ plate	do	R. R. stringers web	0.174	0.278	0.010	0.065
3018	23″ × 7/8″ plate	do	Bottom chord	0.226	0.442	0.013	0.065
2923	56″ × 7/16″ plate	do	Portal	0.161	0.450	0.013	0.071
3038	18″ × 3/8″ plate	do	End posts	0.171	0.478	0.014	0.065
3029	14¾″ × 5/8″ plate	do	Bot. chord reinforce web	0.242	0.451	0.013	0.066
3075	14½″ × 9/16″ plate	do	Lower chord reinforce web	0.186	0.478	0.020	0.071
3041	18″ × 9/16″ plate	do	Main hanger posts	0.157	0.466	0.023	0.072
3096	93/8″ × ½″ plate	do	Portal webs	0.185	0.450	0.015	0.070
3104	34¼″ × 3/8″ plate	do	Roadway floor	0.184	0.451	0.018	0.072
3515	24″ × 5/8″ plate	do	Top chord pin plates	0.203	0.433	0.012	0.046
3036	60″ × 17/8″ plate	do	Bedplates	0.324	0.362	0.012	0.045
3434	48½″ × 9/16″ plate	do	R. R. floor beams	0.218	0.360	0.010	0.063
3320	18″ × ¾″ plate	do	Pin plates int. posts	0.194	0.407	0.012	0.067
3444	25½″ × ½″ plate	do	Top chord battens	0.198	0.449	0.036	0.054
3450	30¼″ × 9/16″ plate	do	R. R. floor beams	0.181	0.433	0.013	0.064
3504	34¼″ × 3/8″ plate	do	Roadway floor beams	0.135	0.404	0.012	0.067
3195	24¾″ × ¾″ plate	do	End post webs	0.181	0.343	0.011	0.068
3225	111½″ × ½″ plate	do	Portal gussets	0.183	0.391	0.022	0.042
3547	21½″ × 11/16″ plate	do	Bot. chord pin plates	0.186	0.408	0.034	0.065
11531	24″ × ¾″ plate	Central Iron Works, Harrisburg, Pa.	Web plates end post	0.365	0.427	0.026	0.040
7388	36″ × 3/8″ plate	do	R. R. stringers web	0.372	0.358	0.014	0.030
12132	15″ × 5/8″ plate	do		0.360	0.431	0.020	0.050
10093	36″ × 5/8″ plate	do	R. R. stringer web	0.437	0.480	0.011	0.070

STEEL WIRE ROPE

FROM

BOSTON NAVY YARD.

STEEL WIRE ROPE.

Four types of ropes are represented, designated as types A, B, C, and D, and one sample of rope of annealed wire.

The following table shows the principal elements of each type and size of rope.

Each rope has 6 strands. The wires were galvanized, excepting the annealed rope.

Number of test.	Marks.	Wires.		Sectional area.	Tensile strength.	
		Total number.	Mean diameter.		Total.	Per square inch.
			Inch.	*Sq. inch.*	*Pounds.*	*Pounds.*
8537	Type A, 2¾″ circ	108	0.0581	0.2862	47,980	167,640
8538	.....do	108	.0581	.2862	48,700	170,160
8529	Type B, 1″ circ	66	.0221	.0253	5,080	200,790
8530	Type B, 1¼″ circ	66	.0301	.0470	7,460	158,720
8532	Type B, 1½″ circ	72	.0320	.0579	10,000	172,710
8533	Type B, 2″ circ	72	.0424	.1015	18,980	186,990
8536	Type B, 2¾″ circ	72	.0580	.1901	34,420	181,060
8540	Type B, 3″ circ	72	.0640	.2318	39,960	172,390
8541	Type B, 4½″ circ	84	.0821	.4444	77,960	175,430
8534	Type C, 2¼″ circ	90	.0374	.0990	18,450	186,360
8539	Type C, 3″ circ	90	.0521	.1917	37,400	195,100
8531	Type D, 1½″ circ	114	.0311	.0866	5,410	62,470
8535	Annealed, 2¼″ circ	72	.0459	.1188	12,420	104,550

The samples were prepared for testing with eye splices at the ends.

Elongations were measured, on those ropes with the smaller wires, with a common steel scale, and on those with larger wires with a micrometer.

In general, wire ropes behave in a manner similar to hemp and manila cordage. The full effect on the elongation of the rope is not immediately developed upon the application of the load, additional stretch continuing for an interval of time. Upon release from load the full resilience is sluggishly reached.

Specimen No. 8539, type C, 3″ circumference, was loaded five times and the elongations measured on each occasion. The effects of each series of loads is shown in the following table.

Under the fifth loading the ratio of stress to strain, or apparent modulus of elasticity, was 21,161,000 pounds per square inch.

Applied loads.	Elongations in gauged length of 30″.									
	First loading.		Second loading.		Third loading.		Fourth loading.		Fifth loading.	
	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.	Total.	Successive.
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
1,000	0.	.....	0.	.....	0.	.....	0.	.....	0.	.....
2,000	.0161	0.0161	.0100	0.0100	.0094	0.0094	.0090	0.0090	.0081	0.0081
3,000	.0300	.0139	.0196	.0096	.0179	.0085	.0175	.0085	.0160	.0079
4,000	.0419	.0119	.0279	.0083	.0261	.0082	.0252	.0077	.0234	.0074
5,000	.0520	.0101	.0355	.0076	.0334	.0073	.0324	.0072	.0305	.0071
6,000	.0634	.0114	.0430	.0075	.0407	.0073	.0396	.0072	.0375	.0070
7,000	.0722	.0088	.0505	.0075	.0480	.0073	.0470	.0074	.0447	.0072
8,000	.0810	.0088	.0580	.0075	.0556	.0076	.0543	.0073	.0523	.0076
9,000	.0915	.0105	.0652	.0072	.0625	.0069	.0617	.0074	.0594	.0071
10,000	.1019	.0104	.0736	.0084	.0699	.0074	.0689	.0072	.0665	.0071
11,000	.....	.....	.0821	.0085	.0772	.0073	.....	.....	.....	.....
12,000	.....	.....	.0923	.0102	.0843	.0071	.....	.....	.....	.....
13,000	.....	.....	.1014	.0091	.0919	.0076	.....	.....	.....	.....
14,000	.....	.....	.1114	.0100	.1001	.0082	.....	.....	.....	.....
15,000	.....	.....	.1222	.0108	.1072	.0071	.....	.....	.....	.....
16,000	.....	.....	.....	.....	.1175	.0103	.....	.....	.....	.....
17,000	.....	.....	.....	.....	.1285	.0110	.....	.....	.....	.....
18,000	.....	.....	.....	.....	.1405	.0120	.....	.....	.....	.....
19,000	.....	.....	.....	.....	.1531	.0126	.....	.....	.....	.....
20,000	.....	.....	.....	.....	.1689	.0158	.1460	.....	.....	.....
21,000	.....	.....	.....	.....	.....	.....	.1577	.0117	.....	.....
22,000	.....	.....	.....	.....	.....	.....	.1747	.0170	.....	.....
23,000	.....	.....	.....	.....	.....	.....	.1914	.0167	.....	.....
24,000	.....	.....	.....	.....	.....	.....	.2076	.0162	.....	.....
25,000	.....	.....	.....	.....	.....	.....	.2251	.0175	.....	.....

The amount of zinc on the galvanized wires and chemical composition of the steel wires was found to be—

Description.	Zinc.	Chemical composition.		
		Carbon.	Manganese.	Silicon.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Type A, $2\frac{3}{4}$″ circ	0.70	0.545	0.870	0.171
Type B, 1″ circ	1.50	0.330	0.525	0.070
Type B, $1\frac{1}{4}$″ circ	4.20	0.411	0.530	0.030
Type B, $1\frac{1}{2}$″ circ	1.10	0.419	0.840	0.137
Type B, 2″ circ	1.40	0.530	0.605	0.025
Type B, $2\frac{3}{4}$″ circ	0.48	0.520	0.750	0.314
Type B, 3″ circ	0.85	0.530	0.600	0.021
Type B, $4\frac{1}{2}$″ circ	0.52	0.545	0.710	0.213
Type C, $2\frac{1}{4}$″ circ	1.05	0.400	1.050	0.080
Type C, 3″ circ	0.54	0.545	0.850	0.014
Type D, $1\frac{1}{2}$″ circ	4.10	0.040	0.500	0.020
Annealed, $2\frac{1}{4}$″ circ	.....	0.790	0.454	0.106

No. 8529.

1″ Type B.
Diameter, ″.33; circumference, 1″.05.
Six strands, 11 wires each.
Jute core.
Each strand has a cotton center of 10 threads.
Lay, one turn in 2″.6.
Sectional area of wires, 0.0253 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
100	.....	0.	0.	Initial load.
200	.....	.05	.....	
300	.....	.08	.....	
400	.....	.10	.....	
500	.....	.13	.....	
600	.....	.15	.....	
800	.....	.18	.....	
1,000	.....	.24	.....	
1,200	.....	.27	.....	
1,400	.....	.33	.....	
1,600	.....	.36	.....	
1,800	.....	.40	.....	
2,000	.....	.43	.....	
100	.....	.....	.18	
2,200	.....	.45	.....	
2,400	.....	.50	.....	
2,600	.....	.54	.....	
2,800	.....	.57	.....	
3,000	.....	.59	.....	
100	.....	.....	.25	
3,200	.....	.63	.....	
3,400	.....	.66	.....	
3,600	.....	.70	.....	
3,800	.....	.74	.....	
4,000	.....	.80	.....	
100	.....	.....	.40	
4,200	.....	.86	.....	
4,400	.....	.90	.....	
4,600	.....	1.02	.....	
4,800	.....	1.11	.....	
5,000	.....	1.40	.....	
100	.....	.....	.92	
5,080	200,790	.....	.....	Tensile strength.

Parted 3 strands at the splice.

No. 8530.

1¼″ Type B.
Diameter, ″.44; circumference, 1″.35.
Six strands, 11 wires each.
Each strand has a cotton center of 16 threads.
The rope has a hemp core.
Lay, one turn in 3″.58.
Sectional area of wires, .0470 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
400	.....	.04	.....	
600	.....	.07	.....	
800	.....	.09	.....	
1,000	.....	.13	.....	
1,400	.....	.16	.....	
1,800	.....	.21	.....	
2,000	.....	.24	.....	
200	.....	.....	.08	
2,400	.....	.27	.....	
2,800	.....	.31	.....	
3,000	.....	.33	.....	
3,400	.....	.39	.....	
3,800	.....	.42	.....	
4,000	.....	.45	.....	
200	.....	.....	.18	
4,400	.....	.51	.....	
4,800	.....	.58	.....	
5,000	.....	.61	.....	
5,400	.....	.67	.....	
5,800	.....	.75	.....	
6,000	.....	.80	.....	
200	.....	.....	.44	
6,400	.....	.93	.....	
6,800	.....	1.07	.....	
7,000	.....	1.16	.....	
7,400	.....	1.52	.....	
7,460	158,720	.....	.....	Tensile strength.

Parted 1 strand 19″ from splice.

No. 8531.

1½″ Type D.
Diameter, ″.48; circumference, 1″.48.
Six strands, 19 wires each.
Hemp core.
Lay, one turn in 4″.15.
Sectional area of wires, 0.0866 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
1,000	.....	.06	.....	
2,000	.....	.10	.....	
3,000	.....	.16	.....	
4,000	.....	.33	.....	
200	.....	.....	.21	
5,000	.....	1.19	.....	
200	.....	.....	.99	
5,400	.....	1.90	.....	
5,410	62,470	.....	.....	Tensile strength.

Parted 3 strands 9″ from splice.

No. 8532.

1½″ Type D.
Diameter, ″.49; circumference, 1″.55.
Six strands, 12 wires each.
Each strand has a hemp center with a wire in the hemp. The rope has a hemp core.
Lay, one turn in 3″.85.
Sectional area of wire, 0.0579 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
1,000	.....	.03	.....	
2,000	.....	.09	.....	
3,000	.....	.15	.....	
4,000	.....	.21	.....	
200	.....	.....	.06	
5,000	.....	.27	.....	
6,000	.....	.40	.....	
200	.....	.....	.12	
7,000	.....	.49	.....	
8,000	.....	.62	.....	
200	.....	.....	.27	
9,000	.....	.80	.....	
10,000	172,710	1.22	.....	Tensile strength.

Parted 1 strand at end of the splice.

No. 8533.

2″ Type B.
Diameter, ″.66; circumference, 2″.
Six strands, 12 wires each.
Each strand has a hemp center of 6 threads.
The rope has a hemp core.
Lay, one turn in 4″.35.
Sectional area of wires, 0.1015 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
1,000	.....	.07	.....	
2,000	.....	.14	.....	
3,000	.....	.19	.....	
4,000	.....	.24	.....	
200	.....	.....	.18	
5,000	.....	.33	.....	
6,000	.....	.39	.....	
7,000	.....	.45	.....	
8,000	.....	.52	.....	
200	.....	.....	.32	
9,000	.....	.58	.....	
10,000	.....	.63	.....	
11,000	.....	.70	.....	
12,000	.....	.80	.....	
200	.....	.....	.51	
13,000	.....	.89	.....	
14,000	.....	.98	.....	
15,000	.....	1.10	.....	
16,000	.....	1.21	.....	
200	.....	.....	.89	
17,000	.....	1.43	.....	One broken wire in sight.
18,000	.....	1.79	.....	
18,980	186,990	.....	.....	Tensile strength.

Parted 1 strand at end of the splice.

No. 8534.

$2\frac{1}{4}''$ Type C.
Diameter, ″.68; circumference, 2″.12.
Six strands, 15 wires each.
Each strand has a hemp center of 7 threads.
The rope has a hemp core of 9 threads.
Lay one turn in 4″.70.
Sectional area of wires, 0.0990 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
1,000	.....	.09	.....	
2,000	.....	.16	.....	
3,000	.....	.22	.....	
4,000	.....	.27	.....	
200	.....	.....	.12	
5,000	.....	.33	.....	
6,000	.....	.37	.....	
7,000	.....	.42	.....	
8,000	.....	.47	.....	
200	.....	.....	.21	
9,000	.....	.51	.....	
10,000	.....	.58	.....	
11,000	.....	.63	.....	
12,000	.....	.68	.....	
200	.....	.....	.33	
13,000	.....	.77	.....	
14,000	.....	.84	.....	
15,000	.....	.92	.....	
16,000	.....	1.06	.....	
200	.....	.....	.62	
17,000	.....	1.22	.....	
18,000	.....	1.45	.....	
18,450	186,360	.....	.....	Tensile strength.

Parted 4 strands 4″ from end of splice.

No. 8535.

$2\frac{1}{4}''$ annealed.
Diameter, $''.75$; circumference, $2''.32$.
Six strands, 12 wires each.
Each strand has a hemp center of 7 threads.
The rope has a hemp core of 9 threads.
Lay, one turn in $4''.40$.
Sectional area of wires, 0.1188 square inch.
Gauged length, $50''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inches.*	
200	.....	0.	0.	Initial load.
1,000	.....	.19	.....	
2,000	.....	.37	.....	
3,000	.....	.49	.....	
4,000	.....	.64	.....	
200	.....	.....	.39	
5,000	.....	.77	.....	
6,000	.....	.89	.....	
7,000	.....	1.02	.....	
8,000	.....	1.16	.....	
200	.....	.....	.84	
9,000	.....	1.33	.....	
10,000	.....	1.57	.....	
11,000	.....	1.92	.....	
12,000	.....	3.02	.....	
200	.....	.....	2.58	
12,420	104,550	.....	.....	Tensile strength.

Parted 3 strands $12''$ from the end of the splice.

No. 8536.

$2\frac{3}{4}''$ Type B.
Diameter, ″.91; circumference, 2″.74.
Six strands, 12 wires each.
Each strand has a hemp center of 5 threads.
The rope has a hemp core of 12 threads.
Lay, one turn in 7″.
Sectional area of wires, 0.1901 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
200	.....	0.	0.	Initial load.
1,000	.....	.03	.....	
2,000	.....	.05	.....	
3,000	.....	.08	.....	
4,000	.....	.11	.....	
5,000	.....	.15	.....	
6,000	.....	.17	.....	
7,000	.....	.19	.....	
10,000	.....	.23	.....	
200	.....	.....	.08	
12,000	.....	.28	.....	
14,000	.....	.32	.....	
16,000	.....	.39	.....	
18,000	.....	.44	.....	
20,000	.....	.47	.....	
200	.....	.....	.19	
22,000	.....	.54	.....	
24,000	.....	.63	.....	
26,000	.....	.70	.....	
28,000	.....	.81	.....	
30,000	.....	.94	.....	
200	.....	.....	.48	
32,000	.....	1.08	.....	
34,000	.....	1.30	.....	
34,420	181,060	.....	.....	Tensile strength.

Parted 2 strands at the splice.

No. 8537.

$2\frac{3}{4}''$ Type A, first sample.
Diameter, ″.90; circumference, 2″.77.
Six strands, 18 wires each.
Strands laid up in two coarses of 12 and 6 wires, respectively, with hemp centers of 8 threads.
The rope has a hemp core.
Lay, one turn in 6″.9.
Sectional area of wires 0.2862 square inch.
Gauged length, 50″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
200	----------	0.	0.	Initial load.
1,000	----------	.05	----------	
2,000	----------	.07	----------	
3,000	----------	.09	----------	
4,000	----------	.10	----------	
5,000	----------	.11	----------	
6,000	----------	.12	----------	
8,000	----------	.14	----------	
10,000	----------	.16	----------	
200	----------	----------	.06	
12,000	----------	.18	----------	
14,000	----------	.21	----------	
16,000	----------	.23	----------	
18,000	----------	.25	----------	
20,000	----------	.27	----------	
200	----------	----------	.09	
22,000	----------	.29	----------	
24,000	----------	.33	----------	
26,000	----------	.38	----------	
28,000	----------	.42	----------	
30,000	----------	.44	----------	
200	----------	----------	.15	
32,000	----------	.49	----------	
34,000	----------	.55	----------	
36,000	----------	.57	----------	
38,000	----------	.67	----------	
40,000	----------	.73	----------	
42,000	----------	.79	----------	
44,000	----------	.88	----------	
46,000	----------	.99	----------	
47,980	167,640	----------	----------	Tensile strength.

Parted 2 strands at the splice.

No. 8538.

$2\frac{3}{4}''$ Type A, second sample.
Diameter, $''.90$; circumference, $2''.75$.
Six strands, 18 wires each.
Strands laid up in two courses of 12 and 6 wires, respectively, with hemp centers of 8 threads.
The rope has a hemp core.
Lay, one turn in $6''.75$.
Sectional area of wires, 0.2862 square inch.
Gauged length, $30''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	.....	0.	0.	Initial load.
2,000	.....	.0073	.....	
3,000	.....	.0142	.....	
4,000	.....	.0211	.....	
5,000	.....	.0273	.....	
1,000	.....	.....	.0034	
6,000	.....	.0343	.....	
7,000	.....	.0408	.....	
8,000	.....	.0475	.....	
9,000	.....	.0543	.....	
10,000	.....	.0615	.....	
1,000	.....	.....	.0128	
1,000	.....	.....	.0124	After 16 hours' rest.
10,000	.....	.0632	.....	
11,000	.....	.0704	.....	
12,000	.....	.0770	.....	
13,000	.....	.0843	.....	
14,000	.....	.0925	.....	
15,000	.....	.1010	.....	
10,000	.....	.0765	.....	
5,000	.....	.0508	.....	
1,000	.....	.....	.0266	
15,000	.....	.1040	.....	
16,000	.....	.1115	.....	
17,000	.....	.1189	.....	
18,000	.....	.1273	.....	
19,000	.....	.1358	.....	
20,000	.....	.1441	.....	
20,000	.....	.1467	.....	After 1 minute.
20,000	.....	.1482	.....	After 2 minutes.
20,000	.....	.1490	.....	After 3 minutes.
20,000	.....	.1497	.....	After 5 minutes.
20,000	.....	.1503	.....	After 8 minutes.
20,000	.....	.1508	.....	After 10 minutes.
19,000	.....	.1463	.....	
19,000	.....	.1463	.....	After 1 minute.
18,000	.....	.1417	.....	
18,000	.....	.1416	.....	Do.
17,000	.....	.1369	.....	
17,000	.....	.1369	.....	Do.
16,000	.....	.1320	.....	
16,000	.....	.1320	.....	Do.
15,000	.....	.1270	.....	
15,000	.....	.1270	.....	Do.
14,000	.....	.1219	.....	
14,000	.....	.1219	.....	Do.
13,000	.....	.1169	.....	
13,000	.....	.1168	.....	Do.
12,000	.....	.1119	.....	
12,000	.....	.1118	.....	Do.
11,000	.....	.1067	.....	
11,000	.....	.1067	.....	Do.
10,000	.....	.1016	.....	
10,000	.....	.1016	.....	Do.
9,000	.....	.0965	.....	
9,000	.....	.0965	.....	Do.
8,000	.....	.0914	.....	
8,000	.....	.0914	.....	Do.

No. 8538—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
7,000	.....	.0862	.....	
7,000	.....	.0862	.....	After 1 minute.
6,000	.....	.0808	.....	
6,000	.....	.0808	.....	Do.
5,000	.....	.0757	.....	
5,000	.....	.0756	.....	Do.
4,000	.....	.0700	.....	
4,000	.....	.0699	.....	Do.
3,000	.....	.0640	.....	
3,000	.....	.0639	.....	Do.
2,000	.....	.0572	.....	
2,000	.....	.0570	.....	Do.
1,000	.....	.....	.0484	
1,000	.....	.....	.0478	Do.
2,000	.....	.0549	.....	
2,000	.....	.0550	.....	Do.
3,000	.....	.0610	.....	
3,000	.....	.0610	.....	Do.
4,000	.....	.0666	.....	
4,000	.....	.0666	.....	Do.
6,000	.....	.0771	.....	
6,000	.....	.0772	.....	Do.
8,000	.....	.0875	.....	
8,000	.....	.0877	.....	Do.
10,000	.....	.0981	.....	
10,000	.....	.0982	.....	Do.
12,000	.....	.1087	.....	
12,000	.....	.1088	.....	Do.
14,000	.....	.1193	.....	
14,000	.....	.1195	.....	Do.
16,000	.....	.1299	.....	
16,000	.....	.1303	.....	Do.
18,000	.....	.1412	.....	
18,000	.....	.1414	.....	Do.
20,000	.....	.1527	.....	
20,000	.....	.1531	.....	Do.
21,000	.....	.1597	.....	
22,000	.....	.1666	.....	
23,000	.....	.1750	.....	
24,000	.....	.1833	.....	
25,000	.....	.1932	.....	
20,000	.....	.1705	.....	
15,000	.....	.1451	.....	
10,000	.....	.1189	.....	
5,000	.....	.0927	.....	
1,000	.....	.....	.0623	
5,000	.....	.0870	.....	
10,000	.....	.1137	.....	
15,000	.....	.1405	.....	
20,000	.....	.1676	.....	
25,000	.....	.1974	.....	
25,000	.....	.1998	.....	After 3 minutes.
1,000	.....	.....	.0667	
1,000	.....	.....	.0655	Do.
5,000	.....	.0905	.....	
1,000	.....	.....	.0655	
25,000	.....	.20	.....	
26,000	.....	.21	.....	
28,000	.....	.23	.....	
30,000	.....	.25	.....	
32,000	.....	.28	.....	
34,000	.....	.32	.....	
36,000	.....	.36	.....	
38,000	.....	.39	.....	
40,000	.....	.43	.....	
42,000	.....	.46	.....	
44,000	.....	.53	.....	
46,000	.....	.61	.....	Snapping sounds.
48,000	.....	.75	.....	
48,700	170,160	.....	.....	Tensile strength.

Parted 1 strand at the splice.

No. 8539.

3″ Type C.
Diameter, ″.96; circumference, 2″.97.
Six strands, 15 wires each.
Strands have hemp centers of 13 threads each.
The rope has a hemp core.
Lay, one turn in 8″.30.
Sectional area of wires, 0.1917 square inch.
Gauged length, 30″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	.....	0.	0.	Initial load.
2,000	.....	.0161	.....	
3,000	.....	.0300	.....	
4,000	.....	.0419	.....	
5,000	.....	.0520	.....	
5,000	.....	.0536	.....	After 2 minutes.
1,000	.....	.....	.0159	
6,000	.....	.0634	.....	
7,000	.....	.0722	.....	
8,000	.....	.0810	.....	
9,000	.....	.0915	.....	
10,000	.....	.1019	.....	
1,000	.....	.....	.0305	
2,000	.....	.0405	.....	
3,000	.....	.0501	.....	
4,000	.....	.0584	.....	
5,000	.....	.0660	.....	
6,000	.....	.0735	.....	
7,000	.....	.0810	.....	
8,000	.....	.0885	.....	
9,000	.....	.0957	.....	
10,000	.....	.1041	.....	
11,000	.....	.1126	.....	
12,000	.....	.1228	.....	
13,000	.....	.1319	.....	
14,000	.....	.1419	.....	
15,000	.....	.1527	.....	
15,000	.....	.1556	.....	Do.
1,000	.....	.....	.0497	
2,000	.....	.0591	.....	
3,000	.....	.0676	.....	
4,000	.....	.0758	.....	
5,000	.....	.0831	.....	
6,000	.....	.0904	.....	
7,000	.....	.0977	.....	
8,000	.....	.1053	.....	
9,000	.....	.1122	.....	
10,000	.....	.1196	.....	
11,000	.....	.1269	.....	
12,000	.....	.1340	.....	
13,000	.....	.1416	.....	
14,000	.....	.1498	.....	
15,000	.....	.1569	.....	
16,000	.....	.1672	.....	
17,000	.....	.1782	.....	
18,000	.....	.1902	.....	
19,000	.....	.2028	.....	
20,000	.....	.2186	.....	
1,000	.....	.....	.0745	
2,000	.....	.0835	.....	
3,000	.....	.0920	.....	
4,000	.....	.0997	.....	
5,000	.....	.1069	.....	
6,000	.....	.1141	.....	
7,000	.....	.1215	.....	
8,000	.....	.1288	.....	
9,000	.....	.1362	.....	
10,000	.....	.1434	.....	
9,000	.....	.1374	.....	
8,000	.....	.1307	.....	
7,000	.....	.1239	.....	

No. 8539—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
6,000	----------	.1167	----------	
5,000	----------	.1095	----------	
4,000	----------	.1019	----------	
3,000	----------	.0942	----------	
2,000	----------	.0860	----------	
1,000	----------	----------	.0756	
10,000	----------	.1424	----------	
20,000	----------	.2205	----------	
21,000	----------	.2322	----------	
22,000	----------	.2492	----------	
23,000	----------	.2659	----------	
24,000	----------	.2821	----------	
25,000	----------	.2996	----------	
25,000	----------	.3065	----------	After 2 minutes.
1,000	----------	----------	.1255	
2,000	----------	.1336	----------	
3,000	----------	.1415	----------	
4,000	----------	.1489	----------	
5,000	----------	.1560	----------	
6,000	----------	.1630	----------	
7,000	----------	.1702	----------	
8,000	----------	.1778	----------	
9,000	----------	.1849	----------	
10,000	----------	.1920	----------	
9,000	----------	.1864	----------	
8,000	----------	.1796	----------	
7,000	----------	.1729	----------	
6,000	----------	.1656	----------	
5,000	----------	.1581	----------	
4,000	----------	.1506	----------	
3,000	----------	.1430	----------	
2,000	----------	.1354	----------	
1,000	----------	----------	.1249	
28,000	----------	.35	----------	
30,000	----------	.41	----------	
32,000	----------	.48	----------	
34,000	----------	.56	----------	
36,000	----------	.74	----------	
37,400	195,100	----------	----------	Tensile strength.

Parted one strand 6″ from the end of the splice.

No. 8540.

3″ Type B.
Diameter, ″.98; circumference, 2″.97.
Six strands, 12 wires each.
Strands have hemp centers of 6 threads each.
The rope has a hemp core.
Lay, one turn in 7″.15.
Sectional area of wires, 0.2318 square inch.
Gauged length, 30″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
1,000	.....	0.	0.	Initial load.
2,000	.....	.0122	.....	
3,000	.....	.0265	.....	
4,000	.....	.0430	.....	
5,000	.....	.0575	.....	
6,000	.....	.0736	.....	
7,000	.....	.0875	.....	
8,000	.....	.1020	.....	
9,000	.....	.1170	.....	
10,000	.....	.1334	.....	
10,000	.....	.1398	.....	After 2 minutes.
10,000	.....	.1449	.....	After 5 minutes.
10,000	.....	.1492	.....	After 10 minutes.
10,000	.....	.1517	.....	After 15 minutes.
1,000	.....	.....	.0791	
2,000	.....	.0864	.....	
3,000	.....	.0950	.....	
4,000	.....	.1038	.....	
5,000	.....	.1121	.....	
6,000	.....	.1202	.....	
7,000	.....	.1278	.....	
8,000	.....	.1357	.....	
9,000	.....	.1438	.....	
10,000	.....	.1515	.....	
1,000	.....	.....	.0811	
1,000	.....	.....	.0763	After 2 minutes.
1,000	.....	.....	.0750	After 5 minutes.
10,000	.....	.1516	.....	
10,000	.....	.1536	.....	After 2 minutes.
11,000	.....	.1625	.....	
12,000	.....	.1715	.....	
13,000	.....	.1820	.....	
14,000	.....	.1934	.....	
15,000	.....	.2077	.....	
1,000	.....	.....	.1007	
2,000	.....	.1083	.....	
3,000	.....	.1171	.....	
4,000	.....	.1256	.....	
5,000	.....	.1336	.....	
6,000	.....	.1416	.....	
7,000	.....	.1492	.....	
8,000	.....	.1570	.....	
9,000	.....	.1645	.....	
10,000	.....	.1719	.....	
11,000	.....	.1792	.....	
12,000	.....	.1870	.....	
13,000	.....	.1944	.....	
14,000	.....	.2024	.....	
15,000	.....	.2109	.....	
16,000	.....	.2227	.....	
17,000	.....	.2365	.....	
18,000	.....	.2498	.....	
19,000	.....	.2645	.....	
20,000	.....	.2774	.....	
20,000	.....	.2841	.....	After 2 minutes.
20,000	.....	.2912	.....	After 5 minutes.
20,000	.....	.2961	.....	After 10 minutes.
1,000	.....	.....	.1487	
1,000	.....	.....	.1440	After 3 minutes.
2,000	.....	.1539	.....	
3,000	.....	.1631	.....	

No. 8540—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
4,000	.....	.1721	.....	
5,000	.....	.1805	.....	
6,000	.....	.1887	.....	
7,000	.....	.1968	.....	
8,000	.....	.2045	.....	
9,000	.....	.2117	.....	
10,000	.....	.2196	.....	
11,000	.....	.2270	.....	
12,000	.....	.2341	.....	
13,000	.....	.2420	.....	
14,000	.....	.2494	.....	
15,000	.....	.2566	.....	
16,000	.....	.2645	.....	
17,000	.....	.2716	.....	
18,000	.....	.2799	.....	
19,000	.....	.2876	.....	
20,000	.....	.2963	.....	
20,000	.....	.3002	.....	After 5 minutes.
21,000	.....	.3109	.....	
22,000	.....	.3220	.....	
23,000	.....	.3389	.....	
24,000	.....	.3531	.....	
25,000	.....	.3712	.....	
25,000	.....	.3823	.....	After 2 minutes.
25,000	.....	.3903	.....	After 5 minutes.
1,000	.....	.....	.2106	
1,000	.....	.....	.2039	After 2 minutes.
2,000	.....	.2136	.....	
3,000	.....	.2228	.....	
4,000	.....	.2316	.....	
5,000	.....	.2400	.....	
6,000	.....	.2480	.....	
7,000	.....	.2561	.....	
8,000	.....	.2635	.....	
9,000	.....	.2708	.....	
10,000	.....	.2783	.....	
11,000	.....	.2855	.....	
12,000	.....	.2926	.....	
13,000	.....	.3000	.....	
14,000	.....	.3072	.....	
15,000	.....	.3145	.....	
16,000	.....	.3220	.....	
17,000	.....	.3290	.....	
18,000	.....	.3361	.....	
19,000	.....	.3440	.....	
20,000	.....	.3518	.....	
21,000	.....	.3588	.....	
22,000	.....	.3669	.....	
23,000	.....	.3746	.....	
24,000	.....	.3820	.....	
25,000	.....	.3910	.....	
1,000	.....	.....	.2127	
26,000	.....	.40	.....	
27,000	.....	.43	.....	
28,000	.....	.45	.....	
29,000	.....	.47	.....	
30,000	.....	.51	.....	
31,000	.....	.55	.....	
32,000	.....	.58	.....	
34,000	.....	.65	.....	
36,000	.....	.76	.....	
38,000	.....	.91	.....	
39,960	172,390	.....	.....	Tensile strength.

Parted 2 strands 2″ from the splice.

No. 8541.

$4\frac{1}{2}''$ Type B.
Diameter, 1″.46; circumference, 4″.45.
Six strands, 14 wires each.
Strands have hemp centers of 14 threads each.
The rope has a hemp core.
Lay, one turn in 9″.65.
Sectional area of wires, 0.4444 square inch.
Gauged length, 30″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,000	.....	0.	0.	Initial load.
4,000	.....	.0141	.....	
6,000	.....	.0298	.....	
8,000	.....	.0443	.....	
10,000	.....	.0574	.....	
2,000	.....	.....	.0232	
2,000	.....	.....	.0229	After 2 minutes.
12,000	.....	.0707	.....	
14,000	.....	.0812	.....	
16,000	.....	.0940	.....	
18,000	.....	.1051	.....	
20,000	.....	.1165	.....	
2,000	.....	.....	.0502	
4,000	.....	.0592	.....	
6,000	.....	.0671	.....	
8,000	.....	.0741	.....	
10,000	.....	.0816	.....	
12,000	.....	.0887	.....	
14,000	.....	.0958	.....	
16,000	.....	.1032	.....	
18,000	.....	.1105	.....	
20,000	.....	.1180	.....	
22,000	.....	.1280	.....	
24,000	.....	.1402	.....	
26,000	.....	.1540	.....	
28,000	.....	.1668	.....	
30,000	.....	.1825	.....	
32,000	.....	.2003	.....	
34,000	.....	.2201	.....	
36,000	.....	.2428	.....	
38,000	.....	.2617	.....	
40,000	.....	.2798	.....	
40,000	.....	.2933	.....	After 2 minutes.
40,000	.....	.2999	.....	After 5 minutes.
40,000	.....	.3065	.....	After 10 minutes.
2,000	.....	.....	.1577	
4,000	.....	.1652	.....	
6,000	.....	.1730	.....	
8,000	.....	.1810	.....	
10,000	.....	.1885	.....	
12,000	.....	.1960	.....	
14,000	.....	.2035	.....	
16,000	.....	.2111	.....	
18,000	.....	.2185	.....	
20,000	.....	.2261	.....	
22,000	.....	.2335	.....	
24,000	.....	.2409	.....	
26,000	.....	.2487	.....	
28,000	.....	.2566	.....	
30,000	.....	.2648	.....	
32,000	.....	.2725	.....	
34,000	.....	.2805	.....	
36,000	.....	.2890	.....	
38,000	.....	.2979	.....	
40,000	.....	.3078	.....	
40,000	.....	.3086	.....	After 2 minutes.
2,000	.....	.....	.1623	
44,000	.....	.35	.....	
48,000	.....	.41	.....	
52,000	.....	.47	.....	
56,000	.....	.52	.....	
60,000	.....	.64	.....	

No. 8541—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
64,000	.....	.73	.....	
68,000	.....	.85	.....	
72,000	.....	1.02	.....	
				Stress released to the initial load, a new gauged length of 30″ laid off on the rope and micrometer observations renewed, setting the micrometer at zero reading.
2,000	.....	0.	0.	Initial load.
4,000	.....	.0082	.....	
6,000	.....	.0150	.....	
8,000	.....	.0212	.....	
10,000	.....	.0276	.....	
12,000	.....	.0337	.....	
14,000	.....	.0399	.....	
16,000	.....	.0461	.....	
18,000	.....	.0521	.....	
20,000	.....	.0586	.....	
22,000	.....	.0645	.....	
24,000	.....	.0708	.....	
26,000	.....	.0770	.....	
28,000	.....	.0836	.....	
30,000	.....	.0899	.....	
32,000	.....	.0966	.....	
34,000	.....	.1031	.....	
36,000	.....	.1095	.....	
36,000	.....	.1116	.....	After 30 minutes
38,000	.....	.1174	.....	
40,000	.....	.1240	.....	
38,000	.....	.1189	.....	
36,000	.....	.1139	.....	
34,000	.....	.1083	.....	
32,000	.....	.1025	.....	
30,000	.....	.0964	.....	
28,000	.....	.0900	.....	
26,000	.....	.0838	.....	
24,000	.....	.0773	.....	
22,000	.....	.0712	.....	
20,000	.....	.0645	.....	
18,000	.....	.0580	.....	
16,000	.....	.0514	.....	
14,000	.....	.0447	.....	
12,000	.....	.0380	.....	
10,000	.....	.0315	.....	
8,000	.....	.0250	.....	
6,000	.....	.0184	.....	
4,000	.....	.0119	.....	
2,000	.....	.....	.0050	
2,000	.....	.....	.0029	After 16 hours.
4,000	.....	.0103	.....	
6,000	.....	.0168	.....	
8,000	.....	.0225	.....	
10,000	.....	.0284	.....	
12,000	.....	.0345	.....	
14,000	.....	.0406	.....	
16,000	.....	.0467	.....	
18,000	.....	.0525	.....	
20,000	.....	.0584	.....	
18,000	.....	.0534	.....	
16,000	.....	.0480	.....	
14,000	.....	.0421	.....	
12,000	.....	.0360	.....	
10,000	.....	.0294	.....	
8,000	.....	.0228	.....	
6,000	.....	.0165	.....	
4,000	.....	.0103	.....	
2,000	.....	.....	.0039	
				Micrometer removed. Measurements resumed on first gauged length.
72,000	.....	1.08	.....	
74,000	.....	1.13	.....	
76,000	.....	1.20	.....	
77,960	175,430	.....	.....	Tensile strength.

Parted 1 strand at the end of the splice.

TABULATION OF STEEL WIRE ROPE FROM BOSTON NAVY-YARD.

No. of test.	Marks.	Diameter.	Circumference.	Strands and core.	Description of strands.	Lay, one turn in—	Tensile strength.	Parted.
		Inches.	*Inches.*			*Inches.*	*Pounds.*	
8529	1″ Type B....	0.33	1.05	6 strands and jute core.....	11 wires each, with cotton center of 10 threads.	2.6	5,080	3 strands at the splice.
8530	1¼″ Type B ...	.44	1.35	6 strands and hemp core	11 wires each, with cotton center of 16 threads.	3.58	7,460	1 strand 19″ from splice.
8531	1½″ Type D ...	.48	1.48	.....do	19 wires each.....	4.15	5,410	3 strands 9″ from splice.
8532	1⅝″ Type B ...	.49	1.55	.....do	12 wires each, with hemp center, and a wire in the hemp.	3.85	10,000	1 strand at end of the splice.
8533	2″ Type B	.66	2	.....do	12 wires each, with hemp center of 6 threads.	4.35	18,980	Do.
8534	2¼″ Type C ...	.68	2.12	6 strands and hemp core of 9 threads.	15 wires each, with hemp center of 7 threads.	4.70	18,450	4 strands 4″ from end of the splice
8535	2¼″ annealed ..	.75	2.32	.....do	12 wires each, with hemp center of 7 threads.	4.40	12,420	3 strands 12″ from the end of the splice.
8536	2¾″ Type B ...	.91	2.74	6 strands and hemp core of 12 threads.	12 wires each, with hemp center of 5 threads.	7	34,420	2 strands at the splice.
8537	2¾″ Type A...	.90	2.77	6 strands and hemp core	18 wires each, laid up in two courses of 12 and 6 wires, respectively, with hemp center of 8 threads.	6.9	47,980	Do.
8538	.....do	.90	2.75	.....do	.....do	6.75	48,700	1 strand at the splice.
8539	3″ Type C	.96	2.97	.....do	15 wires each, with hemp center of 13 threads.	8.30	37,400	1 strand 6″ from the end of the splice.
8540	3″ Type B	.98	2.97	.....do	12 wires each, with hemp center of 6 threads.	7.15	39,960	2 strands 2″ from the splice.
8541	4½″ Type B ...	1.46	4.45	.....do	14 wires each, with hemp center of 14 threads.	9.65	77,960	1 strand at the end of the splice.

CORDAGE, MANILA AND HEMP,

FROM

BOSTON NAVY-YARD.

MANILA AND HEMP CORDAGE.

Samples were prepared with eye splices at the ends which were passed over pins held in the jaws of the testing machine.

The splices were wetted before testing.

The elongations of certain of the ropes were measured, the results of which follow in the details of the tests. All other samples were loaded continuously up to the time of rupture.

Large sets accompany the first loading of new rope.

For the purpose of illustrating the behavior after once loading, the samples were released from stresses, the sets determined, and the elongations measured under both ascending and descending loads.

Confirming earlier tests, the elongation at any given load is dependent upon the previous treatment. If the preceding load was a higher one the length of the specimen will be greater than in the case in which the preceding load was lower than the load at the time of the observation.

This peculiar behavior is attributed to the unequal strains in the different yarns composing the rope, due to their variation in length.

For the purpose of showing the variations in the lengths of the strands and the yarns, several short pieces of rope were unlaid and measured, as follows:

Rope.	Length of rope.	Length of strands	Mean length of yarns.						
			Outside course.	Second course.	Third course.	Fourth course.	Fifth course.	Sixth course.	Center.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
$2\frac{1}{2}''$ manila	25	31.25	33.81	.....	.....	.....	.....	.....	31.50
		31.05	.....	.....	.....	.....	.....	.....	.....
		30.65	.....	.....	.....	.....	.....	.....	.....
3'' manila	20	25.00	27.34	.....	.....	.....	.....	.....	25.98
		25.15	.....	.....	.....	.....	.....	.....	.....
		25.05	.....	.....	.....	.....	.....	.....	.....
$3\frac{3}{4}''$ manila	25	30.90	34.42	.....	.....	.....	.....	.....	31.81
		30.70	.....	.....	.....	.....	.....	.....	.....
		31.00	.....	.....	.....	.....	.....	.....	.....
		30.80	.....	.....	.....	.....	.....	.....	.....
	Core, 25.78	30.50	30.90	.....	.....	.....	.....	.....	.....
		30.48	.....	.....	.....	.....	.....	.....	.....
		30.52	31.00	.....	.....	.....	.....	.....	.....
4'' manila	$25\frac{1}{4}$	31.50	34.61	.....	.....	.....	.....	.....	32.52
		31.40	.....	.....	.....	.....	.....	.....	.....
		31.45	.....	.....	.....	.....	.....	.....	.....
		31.50	.....	.....	.....	.....	.....	.....	.....
	Core, 25.78	30.45	31.33	.....	.....	.....	.....	.....	.....
		30.10	.....	.....	.....	.....	.....	.....	.....
		30.30	.....	.....	.....	.....	.....	.....	.....
5'' manila	25	31.50	35.01	32.80	31.71	.....	.....	.....	31.40
		31.70	.....	.....	.....	.....	.....	.....	.....
		31.75	.....	.....	.....	.....	.....	.....	.....
		31.45	.....	.....	.....	.....	.....	.....	.....
	Core, 25.62	30.40	31.62	.....	.....	.....	.....	.....	.....
		30.45	.....	.....	.....	.....	.....	.....	.....
		30.35	.....	.....	.....	.....	.....	.....	.....
5'' hemp boltrope	25	31.45	33.78	32.94	32.15	31.71	31.20	.....	31.25
		31.60	.....	.....	.....	.....	.....	.....	.....
		31.85	.....	.....	.....	.....	.....	.....	.....
7'' hemp	25	32.90	36.36	35.20	34.40	33.68	33.28	32.98	32.85
		33.10	.....	.....	.....	.....	.....	.....	.....
		33.05	.....	.....	.....	.....	.....	.....	.....

The maximum and minimum lengths of yarns in the several courses of the different ropes were found to be—

Course.	Maximum and minimum length of yarns.						
	2½″ manila.	3″ manila.	3¾″ manila.	4″ manila.	5″ manila.	5″ hemp bolt rope.	7″ hemp.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
Outside	33.63	27.00	34.23	32.90	34.75	33.40	35.75
	34.00	27.55	34.70	35.15	35.25	34.05	37.15
Second	.....	.....	.....	.....	32.45	32.20	34.25
	.....	.....	.....	.....	33.05	33.65	36.35
Third	.....	.....	.....	.....	31.55	31.50	33.60
	.....	.....	.....	.....	31.80	32.70	35.55
Fourth	.....	.....	.....	.....	.....	31.35	33.15
	.....	.....	.....	.....	.....	33.45	34.20
Fifth	.....	.....	.....	.....	.....	31.00	33.05
	.....	.....	.....	.....	.....	31.75	33.55
Sixth	.....	.....	.....	.....	.....	.....	32.90
	.....	.....	.....	.....	.....	.....	33.10
Center	.....	25.55	31.70	32.05	.....	.....	.....
	.....	27.40	31.95	32.80	.....	.....	.....
Core of rope	.....	.....	30.80	31.30	31.60	.....	.....
	.....	.....	31.20	31.35	31.65	.....	.....

Determinations were made of the percentages of ash and chemical composition of manila and hemp fiber, using material left over from earlier tests, which gave the following results:

Rope.	Ash.	Composition of ash.						
		Silica.	Iron and al. oxide.	Calcium oxide.	Magnesium oxide.	Manganous oxide.	Potassium oxide.	Carbon, dioxide.
	Per ct.	*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per ct.*	*Per cent.*	*Per cent.*
Manila	1.06	18.28	5.70	12.32	5.14	0.73	44.33	13.50
Hemp, untarred	2.56	18.38	33.67	38.55	Trace.	.30	.....	9.18
Hemp, tarred	2.77	27.00	35.56	28.16	Trace.	.35	.....	8.92

No. 8582.

15-Thread Manila.

Diameter, ″.65; circumference, 1″.94.
Three strands, 5 threads each.
Lay, one turn in 1″.12.
Weight per fathom, 4.5 ounces.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	1.94	Initial load.
400	.....	1.86	.....	.....	
600	.....	3.17	.....	1.15	
800	.....	4.09	.....	.....	
1,000	.....	4.75	.....	1.09	
200	.....	.....	4.12	1.11	
1,200	.....	5.10	.....	.....	
1,400	.....	5.48	.....	1.06	
1,600	.....	.....	.....	.....	Tensile strength.

Parted one strand 4″.5 from splice.

No. 8578.

2″ Manila.

Diameter, ″.78; circumference, 2″.37.
Three strands, 13 threads each.
Lay, one turn in 2″.
Weight per fathom, 12.2 ounces.
Length between eye-splices, 6 feet 5 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	2.37	Initial load.
400	.....	1.46	.....	.....	
600	.....	2.54	.....	.....	
800	.....	3.41	.....	.....	
1,000	.....	4.10	.....	2.06	
1,500	.....	5.39	.....	.....	
2,000	.....	6.41	.....	1.88	
200	.....	.....	5.47	1.96	
2,500	.....	6.96	.....	.....	
3,000	.....	7.49	.....	1.83	
200	.....	.....	6.47	.....	
3,500	.....	7.90	.....	.....	
4,000	.....	8.16	.....	.....	
4,500	.....	8.43	.....	.....	
5,000	.....	.....	.....	.....	Tensile strength.

Sustained maximum load two minutes, then parted one strand at the splice.

No. 8575.

3″ MANILA.

Diameter, 1″.13; circumference, 3″.50.
Three strands, 21 threads each.
Lay, one turn in 3″.
Weight per fathom, 1.70 pounds.
Length between eye-splices, 5 feet, 5 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	3.50	Initial load.
400	.....	0.71	.....	.....	
600	.....	1.52	.....	.....	
800	.....	2.07	.....	.....	
1,000	.....	2.60	.....	3.15	
1,500	.....	3.44	.....	.....	
2,000	.....	4.11	.....	3.00	
2,500	.....	4.61	.....	.....	
3,000	.....	5.15	.....	2.88	
200	.....	.....	4.19	3.00	
3,500	.....	5.50	.....	.....	
4,000	.....	5.72	.....	2.81	
4,500	.....	6.09	.....	.....	
5,000	.....	6.40	.....	2.73	
200	.....	.....	4.94	2.87	
5,500	.....	6.63	.....	.....	
6,000	.....	6.85	.....	.....	
6,500	.....	7.00	.....	.....	
7,000	.....	7.12	.....	2.64	
7,500	.....	7.20	.....	.....	
8,000	.....	7.32	.....	2.60	
200	.....	.....	6.19	2.73	
8,500	.....	7.51	.....	.....	
9,000	.....	7.70	.....	.....	
200	.....	.....	6.50	.....	
9,500	.....	8.00	.....	.....	
10,000	.....	8.18	.....	.....	
10,500	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8574.

$3\frac{1}{4}''$ MANILA.

Diameter, 1″.22; circumference, 3″.62.
Four strands, 18 threads each.
Rope has manila core of 6 threads.
Lay, one turn in 3″.50.
Weight per fathom, 2.22 pounds.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	3.62	Initial load.
400	.....	.78	.....	.....	
600	.....	1.36	.....	.....	
800	.....	1.90	.....	.....	
1,000	.....	2.35	.....	3.50	
1,500	.....	3.27	.....	.....	
2,000	.....	3.97	.....	3.36	
2,500	.....	4.55	.....	.....	
3,000	.....	5.02	.....	3.26	
200	.....	.....	3.72	3.36	
200	.....	.....	3.65	.....	After 1 hour.
3,500	.....	5.40	.....	.....	
4,000	.....	6.00	.....	3.17	
4,500	.....	6.20	.....	.....	
5,000	.....	6.55	.....	3.13	
200	.....	.....	5.20	3.28	
5,500	.....	7.00	.....	.....	
6,000	.....	7.57	.....	.....	
6,500	.....	7.82	.....	.....	
7,000	.....	8.10	.....	.....	
7,500	.....	8.46	.....	.....	
8,000	.....	8.65	.....	.....	
8,500	.....	8.76	.....	.....	
9,000	.....	8.96	.....	2.93	
200	.....	.....	7.34	3.02	
9,500	.....	9.10	.....	.....	
10,000	.....	9.26	.....	.....	
10,500	.....	9.41	.....	.....	
11,000	.....	9.52	.....	.....	
11,500	.....	9.59	.....	.....	
12,000	.....	9.67	.....	.....	
12,500	.....	9.78	.....	.....	
13,000	.....	.....	.....	.....	Tensile strength.

Sustained maximum load three minutes, then parted two strands and the core at the splice.

No. 8571.

4″ MANILA.

Diameter, 1″.50; circumference, 4″.50.
Four strands, 26 threads each.
Rope has manila core of 6 threads.
Lay, one turn in 4″.
Weight per fathom, 3.06 pounds.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	4.50	
400	.....	.75	.....	.....	
600	.....	1.31	.....	.....	
800	.....	1.88	.....	.....	
1,000	.....	2.25	.....	4.15	
1,500	.....	3.07	.....	.....	
2,000	.....	3.71	.....	4.04	
2,500	.....	4.22	.....	.....	
3,000	.....	4.60	.....	3.94	
3,500	.....	5.00	.....	.....	
4,000	.....	5.31	.....	3.85	
200	.....	.....	4.07	3.98	
4,500	.....	5.79	.....	.....	
5,000	.....	6.40	.....	3.75	
5,500	.....	6.80	.....	.....	
6,000	.....	7.26	.....	3.66	
7,000	.....	7.68	.....	.....	
8,000	.....	8.12	.....	3.57	
9,000	.....	8.50	.....	.....	
10,000	.....	8.77	.....	3.46	
200	.....	.....	7.16	3.65	
11,000	.....	9.06	.....	.....	
12,000	.....	9.23	.....	3.41	
13,000	.....	9.47	.....	.....	
14,000	.....	9.70	.....	.....	
15,000	.....	9.98	.....	.....	
16,000	.....	.....	.....	.....	Tensile strength.

Sustained maximum load three minutes, then one strand parted 10″ from the splice.

No. 8568.

5″ MANILA.

Diameter, 1″.79; circumference, 5″.44.
Four strands, 40 threads each.
Rope has manila core of 9 threads.
Lay, one turn in 4″.50.
Weight per fathom, 4.82 pounds.
Length between eye-splices, 6 feet 9 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	5.44	Initial load.
400	.....	.45	.....	.....	
600	.....	.90	.....	.....	
800	.....	1.30	.....	.....	
1,000	.....	1.70	.....	5.28	
1,500	.....	2.42	.....	.....	
2,000	.....	3.00	.....	5.14	
2,500	.....	3.50	.....	.....	
3,000	.....	3.98	.....	5.02	
3,500	.....	4.40	.....	.....	
4,000	.....	4.78	.....	4.93	
4,500	.....	5.10	.....	.....	
5,000	.....	5.43	.....	4.83	
200	.....	.....	4.12	4.99	
6,000	.....	5.89	.....	.....	
7,000	.....	6.35	.....	.....	
8,000	.....	6.75	.....	.....	
9,000	.....	7.14	.....	.....	
10,000	.....	7.50	.....	4.53	
200	.....	.....	6.03	4.74	
11,000	.....	7.71	.....	.....	
12,000	.....	7.89	.....	.....	
13,000	.....	8.14	.....	.....	
14,000	.....	8.32	.....	.....	
15,000	.....	8.53	.....	4.40	
16,000	.....	8.70	.....	.....	
17,000	.....	8.87	.....	.....	
18,000	.....	8.96	.....	.....	
19,000	.....	9.11	.....	.....	
20,000	.....	9.29	.....	4.29	
20,000	.....	9.37	.....	.....	After 3 minutes.
200	.....	.....	7.55	4.53	
21,000	.....	.....	.....	.....	Tensile strength.

Sustained maximum load two minutes, then parted one strand 8″ from the splice.

No. 8567.

$5\frac{1}{2}''$ MANILA.

Diameter, 2″.04; circumference, 6″.16.
Four strands, 49 threads each.
Rope has manila core of 12 threads.
Lay, one turn in 5″.10.
Weight per fathom, 5.88 pounds.
Length between eye-splices, 5 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	6.16	Initial load.
400	.....	.53	.....	.....	
600	.....	1.00	.....	.....	
800	.....	1.43	.....	.....	
1,000	.....	1.80	.....	5.90	
1,500	.....	2.54	.....	.....	
2,000	.....	3.23	.....	5.71	
2,500	.....	3.66	.....	.....	
3,000	.....	4.00	.....	5.60	
3,500	.....	4.42	.....	.....	
4,000	.....	4.85	.....	5.54	
4,500	.....	5.03	.....	.....	
5,000	.....	5.33	.....	5.46	
200	.....	.....	4.00	5.62	
200	.....	.....	3.94	.....	After 2 minutes.
1,000	.....	4.12	.....	.....	
2,000	.....	4.50	.....	.....	
3,000	.....	4.83	.....	.....	
4,000	.....	5.17	.....	.....	
5,000	.....	5.41	.....	.....	
6,000	.....	5.73	.....	.....	
7,000	.....	6.17	.....	5.32	
8,000	.....	6.56	.....	.....	
9,000	.....	6.86	.....	.....	
10,000	.....	7.20	.....	5.16	
200	.....	.....	5.76	5.37	
1,000	.....	5.84	.....	.....	
2,000	.....	6.06	.....	.....	
3,000	.....	6.26	.....	.....	
4,000	.....	6.41	.....	.....	
5,000	.....	6.59	.....	.....	
6,000	.....	6.78	.....	.....	
5,000	.....	6.70	.....	.....	
4,000	.....	6.68	.....	.....	
3,000	.....	6.60	.....	.....	
2,000	.....	6.45	.....	.....	
1,000	.....	6.25	.....	.....	
200	.....	.....	5.81	.....	
200	.....	.....	5.72	.....	After 2 minutes.
200	.....	.....	5.65	.....	After $3\frac{1}{2}$ minutes.
200	.....	.....	5.59	5.38	After 1 hour.
10,000	.....	7.15	.....	.....	
11,000	.....	7.42	.....	.....	
12,000	.....	7.63	.....	.....	
13,000	.....	7.78	.....	.....	
14,000	.....	8.00	.....	.....	
15,000	.....	8.27	.....	4.99	
16,000	.....	8.42	.....	.....	
17,000	.....	8.50	.....	.....	Load released and new stroke of piston taken.
18,000	.....	8.63	.....	.....	
19,000	.....	8.82	.....	.....	
20,000	.....	9.00	.....	5.90	
21,000	.....	9.17	.....	.....	
22,000	.....	9.35	.....	.....	
25,000	.....	.....	.....	.....	Tensile strength.

Sustained the maximum load one minute, then parted two strands and the core at middle of length.

No. 8542.

7″ MANILA.

Diameter, 2″.63; circumference, 7″.90.
Four strands, 78 threads each.
Rope has manila core of 15 threads.
Lay, one turn in 6″.50.
Weight per fathom, 9.25 pounds.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	7.90	Initial load.
400	.....	.58	.....	.....	
600	.....	1.08	.....	.....	
800	.....	1.49	.....	.....	
1,000	.....	1.75	.....	.....	
1,500	.....	2.43	.....	.....	
2,000	.....	2.93	.....	7.45	
2,500	.....	3.37	.....	.....	
3,000	.....	3.83	.....	.....	
3,500	.....	4.05	.....	.....	
4,000	.....	4.37	.....	7.23	
4,500	.....	4.75	.....	.....	
5,000	.....	4.95	.....	.....	
5,500	.....	5.19	.....	.....	
6,000	.....	5.39	.....	7.10	
200	.....	.....	3.68	7.36	
6,000	.....	5.42	.....	.....	
7,000	.....	5.82	.....	.....	
8,000	.....	6.05	.....	6.97	
9,000	.....	6.35	.....	.....	
10,000	.....	6.64	.....	.....	
11,000	.....	6.93	.....	.....	
12,000	.....	7.07	.....	6.80	
13,000	.....	7.33	.....	.....	
14,000	.....	7.45	.....	.....	
15,000	.....	7.75	.....	6.68	
16,000	.....	7.93	.....	.....	
18,000	.....	8.25	.....	.....	
20,000	.....	8.63	.....	6.53	
200	.....	.....	6.53	6.94	
0	.....	.....	.....	.....	
200	.....	.....	5.79	.....	
400	.....	5.86	.....	.....	
600	.....	6.02	.....	.....	
800	.....	6.14	.....	.....	
1,000	.....	6.24	.....	.....	
1,500	.....	6.45	.....	.....	
2,000	.....	6.63	.....	.....	
2,500	.....	6.77	.....	.....	
3,000	.....	6.91	.....	.....	
3,500	.....	7.04	.....	.....	
4,000	.....	7.11	.....	.....	
4,500	.....	7.26	.....	.....	
5,000	.....	7.26	.....	.....	
6,000	.....	7 44	.....	.....	
7,000	.....	7.55	.....	.....	
8,000	.....	7.74	.....	.....	
9,000	.....	7.83	.....	.....	
10,000	.....	7.89	.....	.....	
9,000	.....	7.80	.....	.....	
8,000	.....	7.85	.....	.....	
7,000	.....	7.84	.....	.....	
6,000	.....	7.79	.....	.....	
5,000	.....	7.74	.....	.....	
4,000	.....	7.66	.....	.....	
3,000	.....	7.55	.....	.....	
2,000	.....	7.44	.....	.....	
1,000	.....	7.12	.....	.....	
200	.....	.....	6.52	.....	
41,800	.....	.....	.....	.....	Tensile strength.

Parted two strands 18″ from the splice.

No. 8589.

$2\frac{1}{2}''$ HEMP.

Diameter, ″.91; circumference, 2″.80.
Three strands, 26 threads each.
Lay, one turn in 2″.6.
Weight per fathom, 1.43 pounds.
Length between eye-splices, 6 feet 2 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	2.80	Initial load.
400	.....	.80	.....	.....	
600	.....	1.38	.....	.....	
800	.....	1.86	.....	.....	
1,000	.....	2.24	.....	2.50	
1,500	.....	2.87	.....	.....	
2,000	.....	3.33	.....	2.42	
200	.....	.....	2.91	2.46	
2,500	.....	3.63	.....	.....	
3,000	.....	3.94	.....	2.36	
200	.....	.....	3.38	2.42	
3,500	.....	4.17	.....	.....	
4,000	.....	4.27	.....	2.33	
4,500	.....	4.41	.....	.....	
5,000	.....	4.53	.....	.....	
5,500	.....	4.70	.....	.....	
6,000	.....	4.85	.....	.....	
6,490	.....	.....	.....	.....	Tensile strength.

Parted one strand at the splice.

No. 8588.

$2\frac{1}{2}''$ Russia Hemp.

Diameter, $''.81$; circumference, $2''.45$.
Four strands, 16 threads each.
Rope has hemp core of 4 threads.
Lay, one turn in $2''.37$.
Weight per fathom, 1.30 pounds.
Length between eye-splices, 5 feet 8 inches.
Gauged length, $50''$.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	2.45	Initial load.
400	.....	.75	.....	.....	
600	.....	1.40	.....	.....	
800	.....	1.90	.....	.....	
1,000	.....	2.27	.....	2.32	
1,500	.....	3.08	.....	.....	
2,000	.....	3.61	.....	2.25	
200	.....	.....	3.08	2.29	
2,500	.....	4.23	.....	.....	
3,000	.....	4.47	.....	2.21	
200	.....	.....	3.77	2.24	
3,500	.....	4.83	.....	.....	
4,000	.....	5.05	.....	2.17	
4,500	.....	5.32	.....	.....	
5,000	.....	5.56	.....	.....	
5,500	.....	5.91	.....	.....	
5,950	.....	.....	.....	.....	Tensile strength.

Parted two strands and the core $14''$ from the splice.

No. 8586.

7″ HEMP.

Diameter, 2″.44; circumference, 7″.40.
Three strands, 154 threads each.
Lay, one turn in 6″.50.
Weight per fathom, 11.53 pounds.
Length between eye-splices, 5 feet 11 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	7.40	Initial load.
400	.....	.48	.....	.....	
600	.....	.95	.....	.....	
800	.....	1.34	.....	.....	
1,000	.....	1.67	.....	7.28	
1,500	.....	2.31	.....	.....	
2,000	.....	2.86	.....	7.06	
2,500	.....	3.19	.....	.....	
3,000	.....	3.59	.....	6.96	
200	.....	.....	2.98	7.04	
3,500	.....	3.91	.....	.....	
4,000	.....	4.18	.....	6.85	
4,500	.....	4.44	.....	.....	
5,000	.....	4.60	.....	6.79	
5,500	.....	4.78	.....	.....	
6,000	.....	5.00	.....	.....	
7,000	.....	5.32	.....	.....	
8,000	.....	5.60	.....	6.63	
200	.....	.....	4.40	6.82	
9,000	.....	5.92	.....	.....	
10,000	.....	6.27	.....	6.53	
11,000	.....	6.49	.....	.....	
12,000	.....	6.65	.....	6.48	
200	.....	.....	5.42	6.66	
13,000	.....	6.90	.....	.....	
14,000	.....	7.00	.....	.....	
15,000	.....	7.11	.....	.....	
16,000	.....	7.22	.....	6.37	
200	.....	.....	6.01	6.58	
17,000	.....	7.40	.....	.....	
18,000	.....	7.50	.....	.....	
19,000	.....	7.55	.....	.....	
20,000	.....	7.60	.....	6.32	
200	.....	.....	6.12	6.54	
1,000	.....	6.26	.....	.....	
2,000	.....	6.34	.....	.....	
4,000	.....	6.57	.....	.....	
6,000	.....	6.77	.....	.....	
8,000	.....	6.95	.....	.....	
10,000	.....	7.10	.....	.....	
8,000	.....	7.08	.....	.....	
6,000	.....	7.02	.....	.....	
4,000	.....	6.95	.....	.....	
2,000	.....	6.80	.....	.....	
1,000	.....	6.62	.....	.....	
200	.....	.....	6.33	.....	
20,000	.....	7.64	.....	.....	
22,000	.....	7.75	.....	.....	
24,000	.....	7.90	.....	.....	
26,000	.....	8.06	.....	.....	
28,000	.....	8.20	.....	.....	
30,000	.....	.....	.....	.....	Tensile strength.

Sustained load one-half minute, then parted one strand at the splice.

No. 8594.

$2\frac{1}{2}''$ HEMP BOLT ROPE (TARRED).

Diameter, ″.92; circumference, 2″.80.
Three strands, 26 threads each.
Lay, one turn in 2″.5.
Weight per fathom, 1.36 pounds.
Length between eye-splices, 5 feet 4 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	2.80	Initial load.
400	.....	.95	.....	.....	
600	.....	1.50	.....	.....	
800	.....	1.99	.....	.....	
1,000	.....	2.35	.....	2.52	
200	.....	.....	2.10	2.55	
1,500	.....	2.86	.....	.....	
2,000	.....	3.30	.....	2.45	
2,500	.....	3.67	.....	.....	
3,000	.....	3.97	.....	2.38	
200	.....	.....	3.36	2.44	
3,500	.....	4.28	.....	.....	
4,000	.....	4.43	.....	.....	
4,500	.....	4.58	.....	.....	
5,000	.....	4.75	.....	2.32	
5,500	.....	4.86	.....	.....	
6,000	.....	5.00	.....	.....	
6,490	.....	.....	.....	.....	Tensile strength.

Parted two strands at the splice.

No. 8593.

3″ Hemp Bolt Rope (tarred).

Diameter, 1″.07; circumference, 3″.28.
Three strands, 38 threads each.
Lay, one turn in 2″.8.
Weight per fathom, 2.01 pounds.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	3.28	Initial load.
400	.....	.64	.....	.....	
600	.....	1.13	.....	.....	
800	.....	1.76	.....	.....	
1,000	.....	2.17	.....	2.94	
1,500	.....	2.76	.....	.....	
2,000	.....	3.36	.....	2.86	
200	.....	.....	2.80	2.90	
2,500	.....	3.72	.....	.....	
3,000	.....	4.12	.....	.....	
3,500	.....	4.37	.....	.....	
4,000	.....	4.54	.....	2.74	
200	.....	.....	3.81	2.80	
4,500	.....	4.79	.....	.....	
5,000	.....	4.93	.....	.....	
5,500	.....	5.07	.....	.....	
6,000	.....	5.20	.....	2.68	
200	.....	.....	4.33	2.76	
6,500	.....	5.38	.....	.....	
7.000	.....	5.57	.....	.....	
7,500	.....	5.61	.....	.....	
8,000	.....	5.72	.....	.....	
9,000	.....	5.91	.....	.....	
9,850	.....	.....	.....	.....	Tensile strength.

Parted two strands at the splice.

No. 8592.

5″ Hemp Bolt Rope (tarred).

Diameter, 1″.76; circumference, 5″.40.
Three strands, 101 threads each.
Lay, one turn in 4″.5.
Weight per fathom, 5.56 pounds.
Length between eye-splices, 6 feet.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	5.40	Initial load.
400	.....	.47	.....	.....	
600	.....	1.00	.....	.....	
800	.....	1.25	.....	.....	
1,000	.....	1.53	.....	.....	
200	.....	.....	1.30	.....	
1,500	.....	2.08	.....	.....	
2,000	.....	2.36	.....	4.96	
200	.....	.....	1.88	5.02	
2,500	.....	2.68	.....	.....	
3,000	.....	2.95	.....	4.86	
3,500	.....	3.22	.....	.....	
4,000	.....	3.40	.....	4.77	
200	.....	.....	2.72	4.90	
4,500	.....	3.60	.....	.....	
5,000	.....	3.72	.....	4.73	
5,500	.....	3.82	.....	.....	
6,000	.....	3.96	.....	4.68	
200	.....	.....	3.16	4.83	
6,500	.....	4.11	.....	.....	
7,000	.....	4.23	.....	.....	
7,500	.....	4.31	.....	.....	
8,000	.....	4.39	.....	.....	
8,500	.....	4.42	.....	.....	
9,000	.....	4.50	.....	.....	
9,500	.....	4.55	.....	.....	
10,000	.....	4.64	.....	4.57	
200	.....	.....	3.63	4.74	
11,000	.....	4.75	.....	.....	
12,000	.....	4.88	.....	.....	
13,000	.....	4.98	.....	.....	
14,000	.....	5.10	.....	.....	
15,000	.....	5.19	.....	4.48	
200	.....	.....	4.04	4.66	
16,000	.....	5.37	.....	.....	
17,000	.....	5.40	.....	.....	
18,000	.....	5.49	.....	.....	
19,000	.....	5.55	.....	.....	
20,000	.....	5.67	.....	.....	
21,000	.....	5.70	.....	.....	
22,000	.....	5.80	.....	.....	
23,000	.....	5.88	.....	.....	
24,000	.....	6.00	.....	.....	Tensile strength.

Parted one strand 14″ from the splice.

No. 8597.

RUSSIA HEMP, 1½″ DEEP-SEA LINE.

Diameter, ″.49; circumference, 1″.50.
Three strands, 9 threads each.
Lay, one turn in 1″.25.
Weight per fathom, 7.2 ounces.
Not tarred.
Length between eye-splices, 6 feet 6 inches.
Gauged length, 50″.

Applied loads.		In gauged length.		Circumference.	Remarks.
Total.	Per square inch.	Elongation.	Set.		
Pounds.	*Pounds.*	*Inches.*	*Inches.*	*Inches.*	
200	.....	0.	0.	1.50	Initial load.
400	.....	1.39	.....	.....	
600	.....	2.41	.....	1.34	
800	.....	3.10	.....	.....	
1,000	.....	3.84	.....	1.31	
200	.....	.....	3.30	1.33	
1,200	.....	4.30	.....	.....	
1,400	.....	4.65	.....	.....	
1,600	.....	5.04	.....	.....	
1,800	.....	5.40	.....	.....	
2,000	.....	5.71	.....	1.26	
200	.....	.....	4.70	1.29	
2,200	.....	6.01	.....	.....	Tensile strength.

Parted two strands 35″ from the splice.

TABULATION OF TENSILE TESTS OF HEMP AND MANILA CORDAGE FROM BOSTON NAVY-YARD.

Secured at ends by means of pins passing through eye-splices. Splices wetted before testing.
Length of samples between splices, 5 to 6 feet.

MANILA ROPE.

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	No. of strands.	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
	Inches.	*Inches.*	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Lbs. Oz.*	*Pounds.*	
8585	6-thread.	0.83	0.27	3	2	.....	0.75	24 8	0 7	0 1.7	536	1 strand 22″ from the splice.
8584	9-thread.	1.04	.33	3	3	.....	.87	24 9	0 11¼	0 2.7	990	1 strand 35″ from the splice.
8583	12-thread.	1.17	.38	3	4	.....	1	24 7	0 14¾	0 3.6	1,580	2 strands at the splice.
8582	15-thread.	1.37	.44	3	5	.....	1.12	24 4	1 2¼	0 4.5	1,600	1 strand 45″ from the splice.
8581	1¼	1.50	.47	3	6	.....	1.37	20 7¼	1 2¾	0 5.5	2,560	1 strand 24″ from the splice.
8580	1½	1.65	.54	3	7	.....	1.37	23 6	1 10	0 6.6	2,390	1 strand 9″ from the splice.
8579	1¾	1.94	.65	3	9	.....	1.75	24 2½	2 5	0 9.2	3,420	1 strand at the splice.
8578	2	2.37	.78	3	13	.....	2	20 ½	2 8¾	0 12.2	5,000	Do.
8577	2¼	2.66	.89	3	14	.....	2.50	20 1	3 15¾	1.19 0	7,240	Do.
8576	2¾	3.21	1.04	3	18	.....	2.75	23 11¾	5 14	1.47 0	9,920	Do.
8575	3	3.50	1.13	3	21	.....	3	20 1	5 11	1.70 0	10,500	Do.
8574	3¼	3.62	1.22	4	18	6	3.50	23 9¼	8 13	2.22 0	13,000	2 strands and core at the splice.
8573	3½	3.95	1.31	4	20	6	3.65	20 ¼	7 15	2.40 0	13,800	1 strand at middle of length.
8572	3¾	4.02	1.34	4	22	6	3.70	20 ½	10 8	3.14 0	16,250	2 strands and core at the splice.
8571	4	4.50	1.50	4	26	6	4	19 11½	10 2¾	3.06 0	16,000	1 strand 10″ from the splice.
8570	4½	5.12	1.68	4	33	9	4.25	20 5¾	13 9½	3.98 0	18,200	2 strands and core 20″ from the splice.
8569	4¾	5.30	1.75	4	37	9	4.50	23 10½	17 15½	4.51 0	22,700	2 strands and core 30″ from the splice.
8568	5	5.44	1.79	4	40	9	4.50	24 5½	19 10¼	4.82 0	21,000	1 strand 8″ from the splice.
8567	5½	6.16	2.04	4	49	12	5.10	23 5¾	23 0¼	5.88 0	25,000	2 strands and core at middle of length.
8542	7	7.90	2.63	4	78	15	6.50	24 5½	37 12	9.25 0	41,800	2 strands 18″ from the splice.

HEMP ROPE (TARRED).

8591	1¾	1.90	0.61	3	12	.....	1.9	24 0¼	2 10¾	0 10.7	3,010	1 strand at the splice.
8590	2	2.05	.68	3	16	.....	2.12	23 8⅝	3 6¼	0 13.7	3,810	Do.
8589	2½	2.80	.91	3	26	.....	2.6	23 5	5 9	1.43 0	6,490	Do.
8588	2½ Russia.	2.45	.81	4	16	4	2.37	24 1	5 3¼	1.30 0	5,950	2 strands and core 14″ from the splice.
8587	2¾	3.05	1.	3	32	.....	3.75	23 6½	7 2½	1.83 0	7,310	1 strand at the splice.
8586	7	7.40	2.44	3	154	.....	.....	24 9½	47 10	11.53 0	30,000	Do.

Tabulation of tensile tests of hemp and manila cordage from Boston Navy-yard—Continued.

HEMP BOLT ROPE (TARRED).

No. of test.	Nominal size of rope.	Actual circumference.	Diameter.	No. of strands	Threads per strand.	Threads in core.	Lay, one turn in—	Length.	Weight.	Weight per fathom.	Tensile strength.	Parted.
	Inches.	*Inches.*	*Inches.*				*Inches.*	*Ft. In.*	*Lbs. Oz.*	*Lbs. Oz.*	*Pounds.*	
8596	1½	1.75	0.58	3	10	.....	1.5	20 6⅛	1 13	0 8.5	2,576	2 strands at the splice.
8595	2	2.25	.73	3	17	.....	2	20 1½	3 2¼	0 15	4,360	Do.
8594	2½	2.80	.92	3	26	.....	2.5	19 10¾	4 8	1.36 0	6,490	Do.
8593	3	3.28	1.07	3	38	.....	2.8	20 ⅞	6 12	2.01 0	9,850	Do.
8592	5	5.40	1.76	3	101	.....	4.5	23 9½	22 ¾	5.56 0	24,000	1 strand 14 ′ from the splice.

RUSSIA HEMP. DEEP-SEA LINE (NOT TARRED).

8597	1½	1.50	0.49	3	9	.....	1.25	24 3	1 13¼	0 7.2	2,200	2 strands 35″ from the splice.

LINEN SHOT LINES

FOR THE

UNITED STATES LIFE-SAVING SERVICE.

LINEN SHOT LINES.

In taking out the samples for test from the coils it was found that, in drawing the ends from under the sisal straps used for holding the coils in shape, a considerable part of the original twist in the lines was unlaid.

These samples, taken for the most part from the inside ends of the coils, were duplicated with additional samples taken from the same ends of the coils as before, the original twist being carefully retained in the duplicates.

In some of the coils the line immediately at the inside end was slack laid.

No. 4 Shot Lines.

Diameter, ″.13.
Three strands of 4 threads each.
Threads two-ply.
Lay, one turn in $\frac{5}{8}$″ to $\frac{3}{4}$″.
Tested in 4-feet lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. Oz.		*Pounds.*	
8085	9 10	Inside	412	1 strand at the middle.
8086	9 8	Outside.....	408	2 strands 6″ from pin.
8087	9 9	Inside	404	1 strand at the middle.
8088	9 11	Outside.....	402	1 strand 7″ from pin.
8089	9 10	Inside	388	1 strand 14″ from pin.
8090	9 13	.....do	401	1 strand 22″ from pin.
8091	9 12	Outside.....	421	3 strands at the middle.
8092	10 2	Inside	418	2 strands at pin.
8093	10 4	Outside.....	430	1 strand 14″ from pin.
8094	9 12	Inside	388	1 strand 24″ from pin.
8095	10 1	Outside.....	462	1 strand 12″ from pin.
8096	9 15	Inside	387	2 strands 14″ from pin.
8097	9 15	Outside.....	404	1 strand 14″ from pin.
8098	9 14	Inside	398	1 staand at middle.
8099	10 2	Outside.....	449	2 strands 21″ from pin.
8100	9 13	Inside	442	1 strand at pin.
8101	9 11	Outside.....	368	1 strand 16″ from pin.
8102	9 14	Inside	405	1 strand 9″ from pin.
8103	10 4	Outside.....	400	1 strand at pin.
8104	9 11	Inside	402	Do.
8105	9 14	.....do	386	1 strand 8″ from pin.
8106	10 1	Outside.....	386	1 strand 12″ from pin.
8107	10 2	Inside	392	1 strand 18″ from pin.
8108	9 14	Outside.....	395	3 strands 18″ from pin.
8109	9 14	Inside	382	2 strands 18″ from pin.
8110	10 1	Outside.....	428	3 strands 3″ from pin.
8111	10 0	Inside	452	2 strands at pin.
8112	10 3	Outside.....	412	Do.
8113	9 15	Inside	405	1 strand 22″ from pin.
8114	10 1	Outside.....	420	2 strands at pin.
8115	10 1	Inside	400	2 strands 5″ from pin.
8116	10 0	Outside.....	436	1 strand at the middle.
8117	10 0	Inside	384	1 strand 10″ from pin.
8118	10 1	Outside.....	442	2 strands 5″ from pin.
8119	10 0	Inside	260	1 strand 5″ from pin.
8119*a*	10 0	.....do	338	1 strand 7″ from pin.
8120	10 0	Outside.....	398	1 strand at the middle.
8121	9 13	Inside	270	1 strand 8″ from pin.
8121*a*	9 13	.....do	367	1 strand 12″ from pin.
8122	10 1	Outside.....	391	2 strands at pin.
8123	9 12	Inside	392	1 strand 15″ from pin.
8124	9 15	Outside.....	402	1 strand 7″ from pin.
8125	9 10	Inside	403	2 strands 8″ from pin.
8126	9 13	Outside.....	396	1 strand 15″ from pin.
8127	9 11	.....do	392	1 strand 24″ from pin.
8128	9 13	Inside	401	3 strands at pin.
8129	9 13	Outside.....	376	1 strand 21″ from pin.

No. 4 Shot Lines—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. Oz.		*Pounds.*	
8130	9 14	Outside.....	397	1 strand 14″ from pin.
8131	9 14	Inside	384	1 strand 19″ from pin.
8132	9 14	Outside.....	412	2 strands 8″ from pin.
8133	9 13	Inside	389	1 strand 20″ from pin.
8134	9 15	Outside.....	379	1 strand 7″ from pin.
8135	10 0	Inside	392	3 strands 9″ from pin.
8136	10 0	Outside.....	399	2 strands 2″ from pin.
8137	10 0	Inside	384	1 strand at the middle.
8138	10 0	Outside.....	386	1 strand 19″ from pin.
8139	9 15	Inside	361	1 strand 12″ from pin.
8140	10 2	Outside.....	400	1 strand 7″ from pin.
8141	10 3	Inside	344	1 strand 20″ from pin.
8142	10 3	Outside.....	394	1 strand 18″ from pin.
8143	10 3	Inside	387	1 strand at the middle.
8144	10 1	Outside.....	402	1 strand 21″ from pin.
8145	10 1	Inside	376	1 strand 14″ from pin.
8146	10 2	Outside.....	398	2 strands 17″ from pin.
8147	10 2	Inside	405	2 strands 16″ from pin.
8148	10 4	Outside.....	399	2 strands at the middle.
8149	10 1	Inside	404	Do.
8150	9 14	.....do	346	1 strand 17″ from pin.
8151	9 11	Outside.....	395	1 strand 10″ from pin.
8152	9 10	.....do	358	1 strand at the middle.
8153	9 11	Inside	381	1 strand 9″ from pin.
8154	9 14	Outside.....	396	2 strands at the middle.
8155	10 0	.....do	384	3 strands 20″ from pin.
8156	9 14	Inside	361	3 strands 18″ from pin.
8157	10 0	Outside.....	342	1 strand 6″ from pin.
8158	9 15	Inside	402	1 strand at pin.
8159	10 1	Outside.....	396	3 strands 18″ from pin.
8160	10 1	Inside	382	1 strand 16″ from pin.
8161	10 3	Outside.....	384	1 strand 13″ from pin.
8162	10 1	Inside	386	1 strand 4″ from pin.
8163	10 3	Outside	402	1 strand at the middle.
8164	10 3	Inside	398	3 strands 12″ from pin.
8165	10 0	Outside.....	389	1 strand 15″ from pin.
8166	9 15	Inside	397	2 strands 14″ from pin.
8167	10 0	Outside.....	350	1 strand 17″ from pin.
8168	10 1	Inside	416	1 strand 14″ from pin.
8169	9 15	Outside.....	400	3 strands at the middle.
8170	9 13	Inside	372	1 strand 3″ from pin.
8171	9 14	.....do	365	1 strand 10″ from pin.
8172	9 14	Outside.....	396	1 strand 17″ from pin.
8173	9 14	.....do	399	2 strands 3″ from pin.
8174	9 13	Inside	378	1 strand 5″ from pin.
8175	9 14	Outside.....	395	1 strand 8″ from pin.
8176	10 0	Inside	387	2 strands 2″ from pin.
8177	9 15	Outside.....	388	2 strands 13″ from pin.
8178	10 1	Inside	366	1 strand at pin.
8179	10 0	Outside.....	419	3 strands at pin.
8180	9 10	Inside	388	1 strand 6″ from pin.
8181	9 10	Outside.....	348	1 strand 14″ from pin.
8182	9 11	Inside	342	1 strand 17″ from pin.
8183	10 0	Outside.....	398	1 strand 14″ from pin.
8184	9 11	Inside	387	1 strand 17″ from pin.

No. 7 Shot Lines.

Diameter, ″.21.
Three strands of 9 threads each.
Threads two-ply.
Lay, one turn in $\frac{11}{16}$″ to $\frac{3}{4}$″.
Tested in 4-feet lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. *Oz.*		*Pounds.*	
7985	20 4	Outside.....	782	1 strand 9″ from pin.
7986	20 4	Inside	866	1 strand at pin.
7987	20 4	Outside.....	799	Do.
7988	20 8	Inside	884	3 strands at pin.
7989	20 4	Outside.....	830	1 strand at middle.
7990	20 0	Inside	776	1 strand 4″ from pin.
7991	20 8	Outside.....	890	1 strand at middle.
7992	20 8	Inside	789	1 strand at pin.
7993	20 4	Outside.....	895	Do.
7994	20 4	Inside	580	Do.
7994*a*		.....do	798	1 strand 10″ from pin.
7995	20 8	Outside.....	846	1 strand 6″ from pin.
7996	20 8	.....do	905	1 strand 22″ from pin.
7997	20 8	.....do	890	1 strand at middle.
7998	20 0	Inside	618	1 strand 24″ from pin.
7998*a*		.....do	778	1 strand 16″ from pin.
7999	20 0	Outside.....	798	1 strand at pin.
8000	20 0	Inside	805	1 strand 18″ from pin.
8001	20 4	Outside.....	799	1 strand at pin.
8002	20 4	Inside	752	3 strands at pin.
8003	20 4	Outside.....	802	1 strand 18″ from pin.
8004	20 4	Inside	785	1 strand at the middle.
8005	20 0	Outside.....	885	Do.
8006	20 4	Inside	798	Do.
8007	20 0	Outside.....	875	1 strand at pin.
8008	20 8	Inside	760	1 strand 2″ from pin.
8009	20 8	.....do	729	1 strand at pin.
8010	20 8	.....do	747	Do.
8011	20 4	Outside.....	886	1 strand at the middle.
8012	20 4	.....do	910	1 strand at pin.
8013	20 0	Inside	805	Do.
8014	20 4	.....do	855	1 strand 14″ from pin.
8015	20 8	Outside.....	854	1 strand at pin.
8016	20 4	Inside	749	1 strand 15″ from pin.
8017	20 8	Outside.....	831	1 strand 18″ from pin.
8018	20 8	Inside	585	1 strand at pin.
8018*a*		.....do	684	2 strands at middle.
8019	20 0	Outside.....	802	1 strand at pin.
8020	20 0	Inside	578	1 strand 2″ from pin.
8020*a*		.....do	795	1 strand at middle.
8021	20 0	Outside.....	818	1 strand 24″ from pin.
8022	20 4	Inside	742	1 strand at pin.
8023	20 8	Outside.....	802	Do.
8024	20 4	Inside	785	1 strand 20″ from pin.
8025	20 8	.....do	602	1 strand at pin.
8025*a*		.....do	762	2 strands at pin.
8026	20 8	Outside.....	748	1 strand 10″ from pin.
8027	20 8	Inside.	783	1 strand 18″ from pin.
8028	20 4	Outside	787	1 strand 20″ from pin.
8029	20 4	Inside	730	1 strand 13″ from pin.
8030	20 4	Outside	902	1 strand 24″ from pin.
8031	20 8	Inside	794	1 strand at pin.
8032	20 0	Outside.....	795	Do.
8033	20 4	Inside	802	Do.
8034	20 8	Outside.....	904	1 strand 6″ from pin.
8035	20 8	Inside	890	1 strand at pin.
8036	20 8	.....do	800	3 strands 20″ from pin.
8037	20 4	Outside.....	849	1 strand at middle.
8038	20 4	Inside	897	Do.
8039	20 8	Outside.....	792	1 strand 22″ from pin.
8040	20 4	Inside	810	1 strand 24″ from pin.
8041	20 8	Outside.....	900	1 strand 15″ from pin.
8042	20 4	Inside	744	1 strand 18″ from pin.
8043	20 8	Outside.....	810	1 strand at pin.
8044	20 8	Inside	878	1 strand 12″ from pin.
8045	20 4	Outside.....	847	1 strand at middle.
8046	20 8	Inside	867	Do.
8047	20 0	.....do	582	1 strand at pin.
8047*a*		.....do	755	2 strands at middle.

No. 7 Shot Lines—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. *Oz.*		*Pounds.*	
8048	20 0	Outside	798	1 strand at pin.
8049	20 0	Inside	875	Do.
8050	20 8	Outside	747	1 strand 24″ from pin.
8051	20 4	Inside	776	1 strand at pin.
8052	20 0	Outside	724	Do.
8053	20 4	Inside	748	1 strand at middle.
8054	20 4	Outside	800	1 strand at pin.
8055	20 0	Inside	798	Do.
8056	20 8	Outside	780	1 strand at middle.
8057	20 0	Inside	794	1 strand 15″ from pin.
8058	20 0	Outside	880	2 strands at pin and 16″ from pin.
8059	20 0	Inside	784	1 strand 12″ from pin.
8060	20 0	Outside	870	1 strand 4″ from pin.
8061	20 0	.....do	852	1 strand at pin.
8062	20 4	Inside	802	2 strands at pin.
8063	20 0	.....do	862	1 strand 18″ from pin.
8064	20 4	Outside	800	1 strand 8″ from pin.
8065	20 4	.....do	898	1 strand at pin.
8066	20 0	.....do	833	Do.
8067	20 0	.....do	756	Do.
8068	20 4	Inside	694	1 strand at middle.
8069	20 4	Outside	852	1 strand at pin.
8070	20 4	Inside	698	Do.
8071	20 0	Outside	672	1 strand 12″ from pin.
8072	20 4	Inside	749	1 strand at middle.
8073	20 4	Outside	795	1 strand 24″ from pin.
8074	20 0	Inside	735	2 strands at middle.
8075	20 0	Outside	864	1 strand at pin.
8076	20 0	Inside	750	Do.
8077	20 0	Outside	795	1 strand 20″ from pin.
8078	20 4	Inside	805	1 strand 6″ from pin.
8079	20 0	Outside	792	1 strand 24″ from pin.
8080	20 0	....do	767	1 strand 2″ from pin.
8081	20 0	Inside	687	1 strand 18″ from pin.
8082	20 4	Outside	746	1 strand at pin.
8083	20 0	.....do	902	1 strand at middle.
8084	20 0	Inside	745	1 strand 22″ from pin.

No. 7 SHOT LINES—Continued.

Diameter, ″.20.
Three strands of 9 threads each.
Threads two-ply.
Lay, one turn in ″.82.
Tested in 4 feet lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. *Oz.*		*Pounds.*	
8404	20 3½	Outside.....	753	1 strand at pin.
8405	20 4½	.....do	849	1 strand 15″ from pin.
8406	20 5½	.....do	652	1 strand 6″ from pin.
8406*a*		.....do	667	1 strand 15″ from pin.
8407	20 7¼	Inside	696	1 strand at pin.
8408	20 9	Outside.....	780	1 strand 15″ from pin.
8409	20 8	.....do	853	1 strand at pin.
8410	20 11½	.....do	772	1 strand 15″ from pin.
8411	20 12	Inside	698	1 strand 2″ from pin.
8412	20 10¼	Outside.....	798	2 strands at pin.
8413	20 11	.....do	741	1 strand 15″ from pin.
8414	20 11¾	.....do	778	1 strand 8″ from pin
8415	20 10	.....do	754	1 strand at pin.
8416	20 5½	Inside	901	1 strand 21″ from pin.
8417	20 7¼	Outside.....	854	1 strand at pin.
8418	20 8½	.....do	848	Do.
8419	20 6½	.....do	905	2 strands at the pin.
8420	20 11¾	Inside	782	Do.
8421	20 7	Outside.....	841	1 strand 15″ from pin.
8422	20 7	.....do	797	1 strand 12″ from pin.
8423	20 7	.....do	846	2 strands 5″ from pin.
8424	20 11½	.....do	782	1 strand 5″ from pin.
8425	20 11	.....do	734	1 strand 8″ from pin.
8426	20 12¾	Inside	702	1 strand at the middle.
8427	20 10½	.....do	696	1 strand 5″ from pin.
8427*a*		.....do	805	Do.
8428	20 13½	Outside.....	802	1 strand 3″ from pin.
8429	20 12	.....do	853	1 strand at the pin.
8430	20 2	.....do	786	1 strand 3″ from pin.
8431	20 5½	.....do	783	1 strand at the pin.
8432	20 2	.....do	732	Do.
8433	20 7	.....do	880	2 strands at the middle.
8434	20 7½	.....do	685	1 strand at the middle.
8434*a*		.....do	702	1 strand 5″ from pin.
8435	20 9	.....do	905	2 strands at the pin.
8436	20 6¼	.....do	802	1 strand 6″ from pin.
8437	20 10¾	.....do	768	1 strand at the pin.
8438	20 10¼	.....do	704	Do.
8439	20 1¼	Inside	636	2 strands 7″ from pin.
8439*a*		.....do	732	1 strand 15″ from pin.
8440	20 11	Outside.....	778	1 strand 2″ from pin.
8441	20 8½	Inside	632	1 strand 10″ from pin.
8441*a*		.....do	800	1 strand 18″ from pin.
8442	20 10	Outside.....	804	2 strands at pin.
8443	20 7	.....do	730	1 strand at pin.
8444	20 10¼	Inside	685	2 strands 5″ from pin.
8444*a*		.....do	808	1 strand 12″ from pin.
8445	20 10¼	Outside.....	771	1 strand at the pin.
8446	20 13½	.....do	756	2 strands at the middle.
8447	20 8¼	.....do	848	1 strand 19″ from pin.
8448	20 7	.....do	826	2 strands at the pin.
8449	20 11	.....do	798	2 strands 12″ from pin.
8450	20 11¼	.....do	750	1 strand at the pin.
8451	20 10	Inside	804	Do.
8452	20 11½	.....do	766	2 strands at the pin.
8453	20 11½	Outside.....	885	1 strand at the pin.
8454	20 12¼	.....do	799	1 strand 17″ from pin.
8455	20 11½	.....do	795	1 strand at the middle.
8456	20 7½	.....do	847	1 strand at the pin.
8457	20 9¾	.....do	874	3 strands at the pin.
8458	20 6½	.....do	758	1 strand at the pin.
8459	20 6	.....do	782	1 strand 19″ from pin.
8460	20 11¾	.....do	735	1 strand at the middle.
8461	20 11	Inside	638	Do
8461*a*		.....do	740	1 strand at the pin.
8461*b*		.....do	753	Do.
8461*c*		Outside.....	765	2 strands at the pin.
8462	20 7¼	.....do	827	Do.
8463	20 11¼	.....do	805	1 strand 10″ from pin.

No. 7 Shot Lines—Continued.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. Oz.		*Pounds.*	
8464	20 7½	Outside.....	802	1 strand at the pin.
8465	20 7¾	Inside	710	2 strands 6″ from pin.
8465*a*		.....do	789	1 strand 18″ from pin.
8466	20 10	Outside.....	726	1 strand at the middle.
8467	20 13½	.....do	767	1 strand at pin.
8468	20 12½	Inside	686	1 strand at the middle.
8468*a*		.... do	759	1 strand 3″ from pin.
8469	20 12½	Outside.....	798	1 strand 22″ from pin.
8470	20 13¼	.....do	753	1 strand 12″ from pin.
8471	20 3¼	.....do	748	2 strands 3″ from pin.
8472	20 11	.....do	648	1 strand at the middle.
8472*a*		.....do	746	1 strand 18″ from pin.
8473	20 13¼	.....do	769	1 strand at pin.
8474	20 9½	Inside	705	1 strand 15″ from pin.
8475	20 2	.....do	700	1 strand 18″ from pin.
8476	20 7½	Outside.....	804	1 strand at the pin.
8477	20 5½	Inside	814	1 strand 3″ from pin.
8478	20 7¾	Outside.....	804	1 strand 5″ from pin.
8479	20 12	Inside	688	1 strand 19″ from pin.
8480	20 10½	Outside.....	695	1 strand at the middle.
8481	20 6	.....do	840	1 strand 12″ from pin.
8482	20 1¾	.....do	789	1 strand at the pin.
8483	20 7	.....do	876	3 strands at the pin.
8484	20 11	Inside	666	1 strand 12″ from pin.
8484*a*		.....do	796	1 strand 6″ from pin.
8485	20 6¾	Outside.....	798	1 strand at the pin.
8486	20 9¼	.....do	805	1 strand 18″ from pin.
8487	20 12¼	.....do	585	1 strand 12″ from pin.
8487*a*		.... do	798	1 strand 6″ from pin.
8488	20 9½	.....do	830	3 strands at the pin.
8489	20 7½	Inside	744	1 strand 8″ from pin.
8490	20 7¼	Outside.....	828	1 strand at the pin.
8491	20 7¼	.....do	802	2 strands 5″ from pin.
8492	20 9¼	.....do	850	2 strands at the pin.
8493	20 8	.....do	702	1 strand at the middle.
8494	20 8¼	.....do	737	1 strand at the pin.
8495	20 7¼	.....do	788	2 strands at the pin.
8496	20 7¼	Inside	684	1 strand at the pin.
8496*a*		.....do	763	1 strand 3″ from pin.
8497	20 11¼	.....do	749	1 strand 15″ from pin.
8497*a*		.....do	786	1 strand 9″ from pin.
8498	20 14	Outside.....	800	1 strand 17″ from pin.
8499	20 10½	.....do	742	1 strand 14″ from pin.
8500	20 8¾	.....do	679	1 strand at the pin.
8501	20 7½	Inside	760	2 strands 12″ from pin.
8502	20 7½	Outside.....	774	2 strands at the pin.
8503	20 10	Inside	670	1 strand at the middle.

Tensile Tests of Individual Threads taken from No. 7 Shot Lines.

OUTSIDE END OF COIL NO. 8457.

Strands.	Strength of individual threads.									Tensile strength of strand.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
First	32	28	27	36	32	29	34	32	27	277
Second ..	27	33	34	30	29	29	34	23	33	272
Third....	29	36	32	22	37	27	35	34	14	266
Aggregate strength of threads										815

OUTSIDE END OF COIL NO. 8461.

First	32	34	34	26	29	24	29	28	22	258
Second ..	32	27	27	24	23	29	19	30	23	234
Third....	34	33	30	28	29	27	22	31	22	256
Aggregate strength of threads										748

TENSILE TESTS OF INDIVIDUAL THREADS TAKEN FROM No. 7 SHOT LINES—Continued.

OUTSIDE END OF COIL NO. 8461.

[Threads wetted before testing.]

First	40	44	38	41	33	35	39	40	44	354
Second ..	31	44	38	27	32	34	43	44	37	330
Third....	38	42	42	38	38	31	28	28	34	319
Aggregate strength of threads										1,003

OUTSIDE END OF COIL NO. 8461.

[Threads given additional twist before testing, sufficient to cause slight tendency to kink.]

First	34	29	24	28	31	30	24	23	26	249
Second ..	33	29	32	27	29	26	36	28	30	270
Third....	36	28	26	33	29	33	33	27	32	277
Aggregate strength of threads										796

No. 9 SHOT LINES.

Diameter, ″.27.
Three strands of 16 threads each.
Threads two-ply.
Lay, one turn in $\frac{15}{16}$″ to $1\frac{1}{8}$″.
Tested in 4-feet lengths.

No. of test.	Weight of coil.	End of coil tested.	Tensile strength.	Parted.
	Lbs. oz.		*Pounds.*	
8212	35 12	Outside.....	1,385	1 strand at pin.
8213	35 12	Inside	1,452	Do.
8214	35 12	Outside.....	1,252	Do.
8215	35 0	Inside	1,405	1 strand 24″ from pin.
8216	34 12	Outside.....	1,305	1 strand at pin.
8217	35 0	Inside	1,299	Do.
8218	35 0	Outside.....	1,395	Do.
8219	36 12	Inside	1,290	1 strand 22″ from pin.
8220	36 8	Outside.....	1,389	3 strands at pin.
8221	36 4	Inside	1,592	1 strand at pin.
8222	34 12	Outside.....	1,376	Do.
8223	34 12	Inside	1,220	Do.
8224	34 12	Outside.....	1,374	Do.
8225	34 12	Inside	1,286	Do.
8226	35 0	Outside.....	1,442	Do.
8227	35 0	Inside	1,330	1 strand at the middle.
8228	35 0	.....do	1,305	1 strand 12″ from pin.
8229	36 0	Outside.....	1,387	1 strand at pin.
8230	35 12	Inside	1,415	1 strand 15″ from pin.
8231	35 12	Outside.....	1,348	1 strand 9″ from pin.
8232	35 0	Inside	1,118	1 strand at pin.
8232*a*		.....do	1,305	Do.
8233	36 12	Outside.....	1,256	1 strand at middle.
8234	35 0	Inside	1,336	1 strand 18″ from pin.
8235	35 4	.....do	1,254	1 strand at pin.
8236	36 12	.....do	1,305	1 strand 6″ from pin.
8237	36 8	Outside.....	1,084	1 strand at pin.
8237*a*		.....do	1,130	1 strand 18″ from pin.
8238	35 0	Inside	1,306	1 strand at pin.
8239	35 0	Outside.....	1,370	Do.
8240	35 4	Inside	1,396	1 strand at the middle.
8241	35 0	.....do	1,185	Do.
8242	35 4	.....do	1,255	Do.
8243	35 4	Outside.....	1,242	2 strands at the pin.
8244	35 8	Inside	1,496	1 strand 12″ from pin.
8245	34 0	.....do	1,200	1 strand at the middle.

No. 9 Shot Lines—Continued.

No. of test.	Weight of coil.		End of coil tested.	Tensile strength.	Parted.
	Lbs.	*oz.*		*Pounds.*	
8246	34	12	Inside	1,086	1 strand at pin.
8246*a*			do	1,180	Do.
8247	34	8	do	1,190	Do.
8248	35	0	do	1,198	Do.
8249	34	12	do	1,052	1 strand 4″ from pin.
8249*a*			do	1,315	1 strand at the middle.
8250	35	0	Outside	1,340	1 strand at the pin.
8251	35	0	Inside	1,220	1 strand 2″ from pin.
8252	35	0	Outside	1,259	1 strand at pin.
8253	35	0	do	1,195	1 strand at the middle.
8254	34	12	Inside	1,296	1 strand at pin.
8255	35	0	Outside	1,292	1 strand at the middle.
8256	34	12	Inside	1,198	1 strand at pin.
8257	35	0	Outside	1,148	Do.
8258	35	0	Inside	1,032	1 strand 12″ from pin.
8258*a*			do	1,200	1 strand at the middle.
8259	35	0	Outside	1,384	2 strands at pin.
8260	34	12	Inside	1,366	1 strand at pin.
8261	35	0	do	1,366	1 strand 6″ from pin.
8262	36	0	do	1,292	1 strand at middle.
8263	36	0	Outside	1,284	1 strand at pin.
8264	36	4	Inside	1,316	1 strand 9″ from pin.
8265	35	0	Outside	1,186	Do.
8266	35	0	Inside	1,189	1 strand 15″ from pin.
8267	35	0	Outside	1,328	1 strand 18″ from pin.
8268	35	0	Inside	1,179	1 strand 17″ from pin.
8269	35	0	do	1,353	1 strand at pin.
8270	35	0	Outside	1,455	Do.
8271	35	4	Inside	1,198	1 strand 15″ from pin.
8272	35	4	do	1,405	1 strand at pin.
8273	34	12	Outside	1,392	2 strands at pin.
8274	36	0	Inside	1,440	1 strand at pin.
8275	36	4	Outside	1,175	1 strand at the middle.
8276	35	4	Inside	1,398	1 strand at pin.
8277	35	8	do	1,384	Do.
8278	35	8	Outside	1,384	2 strands at pin.
8279	35	8	Inside	1,453	1 strand at pin.
8280	35	4	Outside	1,508	1 strand 2″ from pin.
8281	35	8	do	1,230	1 strand at pin.
8282	36	4	Inside	1,510	Do.
8283	34	12	Outside	1,488	1 strand 18″ from pin.
8284	35	0	Inside	1,375	1 strand at pin.
8285	35	4	Outside	1,194	Do.
8286	35	0	do	1,286	2 strands at pin.
8287	34	12	Inside	1,280	1 strand 3″ from pin.
8288	35	0	Outside	1,405	1 strand at pin.
8289	35	8	Inside	1,449	1 strand 8″ from pin.
8290	35	8	do	1,378	1 strand at pin.
8291	35	12	Outside	1,297	2 strands at pin.
8292	35	0	Inside	1,270	1 strand 24″ from pin.
8293	36	4	Outside	1,285	1 strand at pin.
8294	35	0	do	1,302	1 strand 5″ from pin.
8295	35	0	Inside	1,291	1 strand at pin.
8296	35	8	Outside	1,395	2 strands at pin.
8297	36	0	Inside	1,495	1 strand at pin.
8298	36	12	Outside	1,192	1 strand at the middle.
8299	35	0	do	1,236	1 strand at pin.
8300	35	0	Inside	1,235	Do.
8301	35	4	do	1,400	1 strand at the middle.
8302	35	8	do	1,377	1 strand at pin.
8303	35	12	Outside	1,248	2 strands at pin.
8304	34	12	Inside	1,163	1 strand 18″ from pin.
8305	35	0	Outside	1,164	1 strand at pin.
8306	35	4	do	1,250	2 strands at pin.
8307	36	12	Inside	1,451	1 strand 6″ from pin.
8308	36	4	Outside	1,190	1 strand at pin.
8309	35	0	Inside	1,188	1 strand 4″ from pin.
8310	35	0	Outside	1,410	1 strand at pin.
8311	35	0	Inside	1,356	1 strand 12″ from pin.

PRIVATE TESTS.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1896.

Date.	Material.	For whom tested.		
		Name.	City.	State
1895.				
July...	Granite	Pigeon Hill Granite Co	Rockport	Mass.
	Cement	City of Boston	Boston	Mass.
	Cast iron	Pittsburg Testing Laboratory	Pittsburg	Pa.
	Bronze	....do	....do	Pa.
	Concrete	Boston Transit Com	Boston	Mass.
	Granite	A. J. Salinas & Sons	Charleston	S. C.
	Ramie rope	Wilson & Silsby	Boston	Mass.
	Spring, etc	McKay Met. Fastening Association.	Winchester	Mass.
Aug...	Gun tubes	The Midvale Steel Co	Philadelphia	Pa.
	Charcoal iron	Washburn & Moen Manufacturing Co.	Worcester	Mass.
	Rubber belting	Revere Rubber Co	Boston	Mass.
	Bronze	Ashcroft Manufacturing Co	Bridgeport	Conn.
	....do	Whittier Machine Co	Boston	Mass.
	Cast iron	....do	....do	Mass.
	....do	Pittsburg Testing Laboratory	Pittsburg	Pa.
	Bronze	....do	....do	Pa.
	Steel pinion shaft	....do	....do	Pa.
	Bricks	Wheelwright & Haven	Boston	Mass.
	....do	Stonington Brick and Pottery Co	Stonington	Miss.
	Steel bars	Taylor Steel and Iron Co	High Bridge	N. J.
	Steel tubing	Peerless Manufacturing Co	Cleveland	Ohio.
	Wrought-iron plates.	Hollingsworth & Whitney Co	Watertown	Mass.
	Steel plate	Rhode Island Locomotive Works	Providence	R. I.
	....do	Schenectady Locomotive Works	Schenectady	N. Y.
	Spruce plugs in cast iron.	W. W. Whitcomb	Boston	Mass.
	Rubber belting	Revere Rubber Co	....do	Mass.
	Bolts	Pittsburg Testing Laboratory	Pittsburg	Pa.
	Cement	City of Boston	Boston	Mass.
	Steel plate	Scannell & Wholey	Lowell	Mass.
Sept...	Cast iron	Armington & Sims Engine Co	Providence	R. I.
	Bronze	Ashcroft Manufacturing Co	Bridgeport	Conn.
	Marble	Westfield Marble and Sand Co	Westfield	Mass.
	Cast iron	Pittsburg Testing Laboratory	Pittsburg	Pa.
	Bronze	....do	....do	Pa.
	Iron castings	A. B. Black	East Lexington	Mass.
	Steel plate	Scannell & Wholey	Lowell	Mass.
	Tubing	Pope Manufacturing Co	Hartford	Conn.
	Manganese bronze	Bath Iron Works	Bath	Me.
Oct....	Coupling link and pin.	New York, New Haven & Hartford R. R.	New Haven	Conn.
	Bricks	E. J. Bardwell	Boston	Mass.
	Bronze	Ashcroft Manufacturing Co	Bridgeport	Conn.
	Rubber belting	Revere Rubber Co	Boston	Mass.
	Steel rod	Pope Manufacturing Co	Hartford	Conn.
	Wrought iron	E. Williams	Pittsfield	Mass.
	Granite	Umlah Granite Co	Rockport	Mass.
	....do	S. F. Draper	Fayville	Mass.
	Steel bars	Taylor Iron and Steel Co	High Bridge	N. J.
	Manhole covers and frames.	City of Boston	Boston	Mass.
	Manganese bronze	Bath Iron Works	Bath	Me.
	Hydraulic gauges	Ashcroft Manufacturing Co	Bridgeport	Conn.
	Rope	Rob't B. Storer & Co	Boston	Mass.
Nov....	Brass and bronze tubing.	Benedict & Burnham Manufacturing Co.	....do	Mass.
	Concrete	Norcross Brothers	Providence	R. I.
	Sandstone	City of Buffalo	Buffalo	N. Y.
	Coupling links and pins.	The E. S. Greeley & Co	New York	N. Y.
	Steel bars	Taylor Iron and Steel Co	High Bridge	N. J.
	Manganese bronze	Bath Iron Works	Bath	Me.
	Wood	Wason Manufacturing Co	Springfield	Mass.
	Copper cylinders	The Giant Powder Co	San Francisco	Cal.
Dec....	Bricks	Chas. E. Cotting	Boston	Mass.
	Manganese bronze	Bath Iron Works	Bath	Me.
	Steel hawsers	J. A. Roebling's Sons Co	Trenton	N. J.
	Wood	Wason Manufacturing Co	Springfield	Mass.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1895.				
Dec....	Bricks	Norcross Brothers	Boston	Mass.
	Riveted leather	Judson L. Thomson Manufacturing Works.	Waltham	Mass.
	Wrought-iron bars	Rhode Island Locomotive Works	Providence	R. I.
	Wrought-iron castings.	Standard Iron and Steel Co	New York	N. Y.
	Cast iron	Atlantic Works	Boston	Mass.
1896.				
Jan....	Tie rods	West End Street Railway Co	....do	Mass.
	Steel plate	Wm. Allen & Sons	Worcester	Mass.
	Cast iron	Farrel Foundry and Machine Co	Ansonia	Conn.
	Tubing	Warwick and Stockton Co	Newark	N. J.
	Maganese bronze	Atlantic Works	Boston	Mass.
	....do	Bath Iron Works	Bath	Me.
Feb	Cast iron	Whittier Machine Co	Boston	Mass.
	Steel plates	Wm. Allen & Sons	Worcester	Mass.
	Wrought-iron pipes.	A. H. Marden	Boston	Mass.
	Manila rope	Standard Rope & Twine Co	Allston	Mass.
	Rubber belting	Revere Rubber Co	Boston	Mass.
	Sea island cotton	Fearing Hall & Whiton	....do	Mass.
	Pig iron	Richmond Iron Works	Richmond Furnace	Mass.
	Granite	Albany Manufacturing Co	Albany	N. Y.
	Copper plate and joints.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	Steel plates	E. D. Leavitt	Cambridgeport	Mass.
Mar	Bronze	Atlantic Works	East Boston	Mass.
	Steel bars	Keystone Axle Co	Baltimore	Md.
	Cast-iron columns.	J. B. & J. M. Cornell	New York	N. Y.
	Paving bricks	D. P. Guise	Williamsport	Pa.
	Steel wire	John Wales Co	Boston	Mass.
	Wire ropes	Edward E. Odell	....do	Mass.
	Sea island cotton	Fearing Hall & Whiton	....do	Mass.
	Wrought-iron bar.	Brown & Co., Incorporated	Pittsburg	Pa.
	Cast iron	Whittier Machine Co	Boston	Mass.
	Manila rope	Standard Rope and Twine Co	Allston	Mass.
	Wrought-iron bars	Kinsley Iron and Machine Co	Canton	Mass.
	Cast iron	Bath Iron Works	Bath	Me.
	Bronze	....do	....do	Me.
	Stone	E. W. Serrell	New York	N. Y.
Apr	Wrought-iron bars	Kinsley Iron and Machine Co	Canton	Mass.
	Bronze	Bath Iron Works	Bath	Me.
	Sheet steel	Howe, Brown & Co	Boston	Mass.
	Steel bars	Bath Iron Works	Bath	Me.
	Nickel steel	Herring Safe Works	New York	N. Y.
	Cast iron	Franklin Iron Foundry	Milford	Mass.
	Iron book shelf	Snead & Co. Iron Works	Louisville	Ky.
	Steel-wire rope	Boston and Albany R. R	Boston	Mass.
	Low moor iron	Houghton & Richards	....do	Mass.
	Steel plates	Henry W. Belcher	New York	N. Y.
	Granite	H. E. Fletcher	West Chelmsford	Mass.
	White-ash wood	Wason Manufacturing Co	Springfield	Mass.
	Steel bolt	Herring Safe Works	New York	N. Y.
	Crosshead pin	Herreshoff Manufacturing Co	Bristol	R. I.
	Brake beam	A. H. Marden	Boston	Mass.
May	School furniture	Chandler Adjustable Chair and Desk Co.	....do	Mass.
	Steel casting	Isaac G. Johnson & Co	Spuyten Duyvil	N. Y.
	Cast-iron bracket.	A. E. Martin	So. Framingham	Mass.
	Steel plates	Henry W. Belcher	New York	N. Y.
	Railroad spikes	New England Railroad Co	Boston	Mass.
	Steel bars	Bath Iron Works	Bath	Me.
	Steel plate	Howe, Brown & Co	Boston	Mass.
	Brake beam	A. H. Marden	....do	Mass.
	Rail joint	Weber Railway Joint Manufacturing Co.	New York	N. Y.
	Pudding stone	Edwd. St. Clair Fellows	Boston	Mass.
	Concrete	Woodbury & Leighton	....do	Mass.
	Piston-rod fastenings.	P. H. Bullock	Concord	Mass.
	Steel bar	Herring Safe Works	New York	N. Y.
	Manganese bronze	Atlantic Works	East Boston	Mass.
	Cast iron	Whittier Machine Co	Boston	Mass.
	....do	New England Piano Co	Roxbury	Mass.
June...	Stone	Wm. Repp	Old Forge	Pa.

PRIVATE TESTS—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1896.				
June...	Concrete	Woodbury & Leighton	Boston	Mass.
	Rail joint	J. H. Williams	....do	Mass.
	Copper cylinders	U. S. Smokeless Powder Co	San Francisco	Cal.
	Cast iron	Whittier Machine Co	Boston	Mass.
	Chain	Washburn & Moen Manufacturing Co.	Worcester	Mass.
	Hydraulic gauge	Star Brass Manufacturing Co	Boston	Mass.
	Manganese bronze	The Wm. Cramp & Sons Ship and Engine Building Co.	Philadelphia	Pa.
	Bronze	Bath Iron Works	Bath	Me.
	Concrete	Woodbury & Leighton	Boston	Mass.
	Stay-bolt iron	Saladi & Fuller	Catasauqua	Pa.
	Bronze	Torrey Roller Bushing Works	Bath	Me.
	Chain	Washburn & Moen Manufacturing Co.	Worcester	Mass.
	Copper plate and joints.	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.

INDEX.

Page.

Analyses, chemical:
- Bands for rifles 431
- Cast iron, with and without alloy 223, 224, 432
- Gun lift carriage, 12-inch, steel casting 432
- Receivers of rifles 431
- Rifle barrel steel 431
- Rope, hemp and manila 460
- Round shot, 10-inch 432
- Steel for Rock Island Bridge 433, 434
- Wire rope, steel 438

Bricks, absorption of water:
- Brooke Terra Cotta Company, Lazearville, W. Va 347
- Chicago Hydraulic Press Brick Company, Chicago, Ill 347
- Clark Pressed Brick Company, Malvern, Ark 347
- Eastern Hydraulic Press Brick Company, Philadelphia, Pa 347
- Gladding, McBean & Co., San Francisco, Cal 347
- Hydraulic Press Brick Company, St. Louis, Mo 347
- Kansas City Hydraulic Press Brick Company, Kansas City, Mo 347
- Northern Hydraulic Press Brick Company, Minneapolis, Minn 347
- Philadelphia and Boston Face Brick Company, Boston, Mass 347
- Powhatan Clay Manufacturing Company, Richmond, Va 347

Bricks, building, compressive elastic properties:
- Remarks 347
- Gay Head Clay and Brick Company, Chelsea, Mass 350, 351
- Gladding, McBean & Co., San Francisco, Cal 365
- Kelley Brick and Tile Company, Minneapolis, Minn 363
- Powhatan Clay Manufacturing Company, Richmond, Va 360
- Sayre & Fisher Company, Sayreville, N. J 354, 357

Bricks, fire, compressive elastic properties:
- Blandford Brick and Tile Company, Russell, Mass 352
- Eharker, John, Ashby, Ala 361
- Gay Head Clay and Brick Company, Chelsea, Mass 349
- Gladding, McBean & Co., San Francisco, Cal 366

Bricks, paving, compressive elastic properties:
- Capital City Vitrified Brick and Paving Company, Topeka, Kans 364
- Franklin Paving Brick Company, Franklin, Pa 358, 359
- Jones, A. O., Brick and Terra Cotta Company, Zanesville, Ohio 362
- New England Steam Brick Company, Providence, R. I 353
- Somerset and Johnsonburg Manufacturing Company, Boston, Mass 348

Bricks, expansion, coefficients of, and treatment in air, and water baths:
- Brooke Terra Cotta Company, Lazearville, W. Va 369
- Chicago Hydraulic Press Brick Company, Chicago, Ill 371
- Clark Pressed Brick Company, Malvern, Ark 370
- Eastern Hydraulic Press Brick Company, Philadelphia, Pa 369

Bricks, expansion, coefficients of, etc.—Continued. Page.
Gladding, McBean & Co., San Francisco, Cal 369
Hydraulic Press Brick Company, St. Louis, Mo 367, 368
Kansas City Hydraulic Press Brick Company, Kansas City, Mo 367
Northern Hydraulic Press Brick Company, Minneapolis, Minn 370
Philadelphia and Boston Face Brick Company, Boston, Mass 368
Powhatan Clay Manufacturing Company, Richmond, Va 367
Bricks, general tabulation 371
Bronze:
Hancock, Gen. W. S., monument 238
Watertown Arsenal—
Breech plates, 8-inch 237
Loading trays, 8-inch 237
Loading trays, 10-inch 237
Loading trays, 12-inch 238
Building block 372
Cast iron:
Gun carriage, 10-inch disappearing 130–132
Pig irons 226
Chemical analyses 226
Watertown Arsenal—
Chemical analyses 223, 224
Cupola iron, steel scrap, and alloy, elongation 205–210
Furnace charges 205, 213–222
Tension tests and specific gravities 223–226
Chain cable and chain iron 229
Cable, United States Navy Department 231
Chain iron, United States Navy Department 232, 233
Copper cylinders for pressure gauges 239
Purchase of, April, 1895—
Tables for gauge one-thirtieth square inch area 243
Tables for gauge one-tenth square inch area 241
Cordage, manila and hemp, from Boston Navy-Yard 457
Remarks 459
Ash, percentage of, in rope 461
Chemical composition 461
Length of strands and yarns 460, 461
Hemp—
2½-inch 468
7-inch 470
Hemp bolt rope—
2¼-inch 471
3-inch 472
5-inch 473
Hemp, Russian—
1½-inch deep sea line 474
2½-inch 469
Manila—
15-thread 461
2-inch 461
3-inch 462
3¼-inch 463
4-inch 464
5-inch 465
5½ inch 466
7-inch 467
Tabulation 475, 476

Page.
Culvert pipe, compression 373
12-inch 377
15-inch 376, 377
18-inch 376
20-inch 376
24-inch 375
30-inch 375
Gas tube, bursting test 341
Gun carriage, 10-inch disappearing 121
Cast iron 130–132
Gun-lever axle, steel 126
Piston rod, steel 124–126
Steel bars 127
Suspension rod, forged steel 123
Wrought-iron bars 129
Gun carriage, 15-inch, old model, piston rods, proof stress 133
Gun specimens:
10-inch steel B. L. rifles 11
Jackets 28–37
Tubes 13–27
Tabulation 38
12-inch steel B. L. rifles 39
Jackets 45–48
Tubes 41–44
Tabulation 49
Helical springs 191
Gun-lift carriages, 12-inch 199
Mortar carriages, 7-inch 200
Mortar carriages, 12-inch spring return 193
Retest of springs that had been closed down 64 hours 197
Springs not previously loaded 198
Hemp rope. (*See* Cordage.)
Manila rope. (*See* Cordage.)
Pig irons 226
Private tests 487
Receivers of rifles, .30 caliber, steel 117
Forged from bar 2″.25 by 1″.7 to dimensions for turning 120
Turned down from bar 2½″ by 1″.7 119
Rifle barrels, hardness 114
Rifle-barrel steel, .30 caliber 51
Barrel No. 7453 115
Bessemer steel 53
Crucible steel 54–59
Metal as received from manufacturers 69, 70
Nickel steel 60–65
Nickel crucible steel, oil tempered and annealed 66, 67
Rolled and annealed in charcoal 72
Rolled into barrel and cooled in air 71
Tabulation 75
Rolled barrels, specially treated 79–108
Regular stock, recent manufacture 101, 102
Regular stock rolled in bar 1″.1 diameter, from which barrels were made without heating 109
Tabulation 112, 113

Page.
Rock Island bridge, steel used in construction 135
Bars 137, 138
Chemical analyses 433, 434
Plate 139
Riveted joints, ½-inch steel plate 245
Metal used in joints 248–500
⅞-inch steel rivets, 15/16-inch drilled holes—
Butt joints, double riveted, 3⅜-inch pitch 252
Butt joints, triple riveted, 2½-inch pitch 253, 255, 258
Butt joints, triple riveted, 3⅜-inch pitch 254, 256, 257
Butt joints, quadruple riveted, 2½-inch pitch 259, 261
Butt joint, quadruple riveted, 2½-inch pitch, tested hot 260
Butt joints, quadruple riveted, 3⅜-inch pitch 262, 264
Lap joint, double riveted, 3⅜-inch pitch 251
Riveted and bolted joints 277
Punched holes; punch 11/16-inch, die ¾-inch diameter—
Angle, 3″ by 3″ by ⅜″, ⅝-inch iron rivets 338
Angle, 3″ by 3″ by ⅜″, ⅝-inch iron rivets and bolts 339
¼-inch steel plate—
⅝-inch iron bolts 315, 318, 321, 337
⅝-inch iron rivets 313, 316, 319, 339
½-inch steel plate—
⅝-inch iron bolts 307, 310, 312, 333, 335
⅝-inch iron rivets 305, 308, 311, 334
¾-inch steel plate—
⅝-inch iron bolts 304, 324, 327, 330
⅝-inch iron rivets 302, 322, 325, 328, 331
Punched holes; punch 13/16-inch, die ⅞-inch diameter—
½-inch steel plate—
¾-inch iron bolts 281, 285, 289
¾-inch iron rivets 280, 283, 287
¾-inch steel bolts 281, 284, 288
¾-inch steel rivets 279, 282, 286
¾-inch steel plate—
¾-inch iron bolts 293, 297, 301
¾-inch iron rivets 291, 295, 299
¾-inch steel bolts 292, 296, 300
¾-inch steel rivets 290, 294, 298
Rope. (*See* Cordage.)
Shells, banded, resistance of, in bores of rifled guns 141
Remarks 143
3.2-inch B. L. steel field rifle, model 1885 145–151
3.2-inch B. L. steel field rifle, model 1890 166
3.2-inch Driggs-Schroeder B. L. steel field rifle 152–165
5-inch B. L. siege rifle 169–172
7-inch B. L. siege howitzer 173–182
8-inch B. L. rifle, steel 183
10-inch B. L. rifle, steel 188
Shot lines 477
Linen, laid, No. 4 479
Linen, laid, No. 7 481
Individual threads 484, 485
Linen, laid, No. 9 485
Springs, helical 191
Springs, steel 201

Steel bars: Page.
Disappearing gun-carriage metal, 10-inch 123–126
Receivers of rifles 117–120
Rifle barrels, .30 caliber 51–115
Rock Island bridge material 137, 138
Steel plate:
Riveted joint metal 248–250
Rock Island bridge material 139
Wire rope, steel, from Boston Navy-Yard 435
Description and remarks 437, 438
Type B—
d meter 439
1¼-inches diameter 440
2-inches diameter 442
2¾-inches diameter 445
3-inches diameter 451
4⅓-inches diameter 453
Type C—
2¼-inches diameter 443
2¼-inches diameter, annealed 444
3-inches diameter 449
Type D, 1½-inches diameter 441
Type H, 2¾-inches diameter 446, 447
Tabulation 455
Wood, Douglas fir 379
Remarks 381
Moduli of elasticity, tension, and compression 382
Ratios of lateral contraction to longitudinal extension, and lateral expansion to longitudinal compression 383
Compression tests—
Compression and lateral expansion 412–415
Parallel and perpendicular to rings of growth 384–390, 393–404
Obliquely to rings of growth 391, 392
Tension tests—
Elongation and lateral contraction 405–411
Tensile strength 416
Wood, white oak 417
Remarks 419
Compression tests, moduli of elasticity—
Crosswise the grain 427
Endwise the grain 420–426
Wrought-iron bars 344

BSB Bayerische StaatsBibliothek
MDZ Münchener DigitalisierungsZentrum Digitale Bibliothek

House documents

Bd.: [478.] 1896/97, Vol. 43 = Congress 54, Sess. 2

Washington, DC 1897
Am.b. 3040-478,43
urn:nbn:de:bvb:12-bsb11799842-7